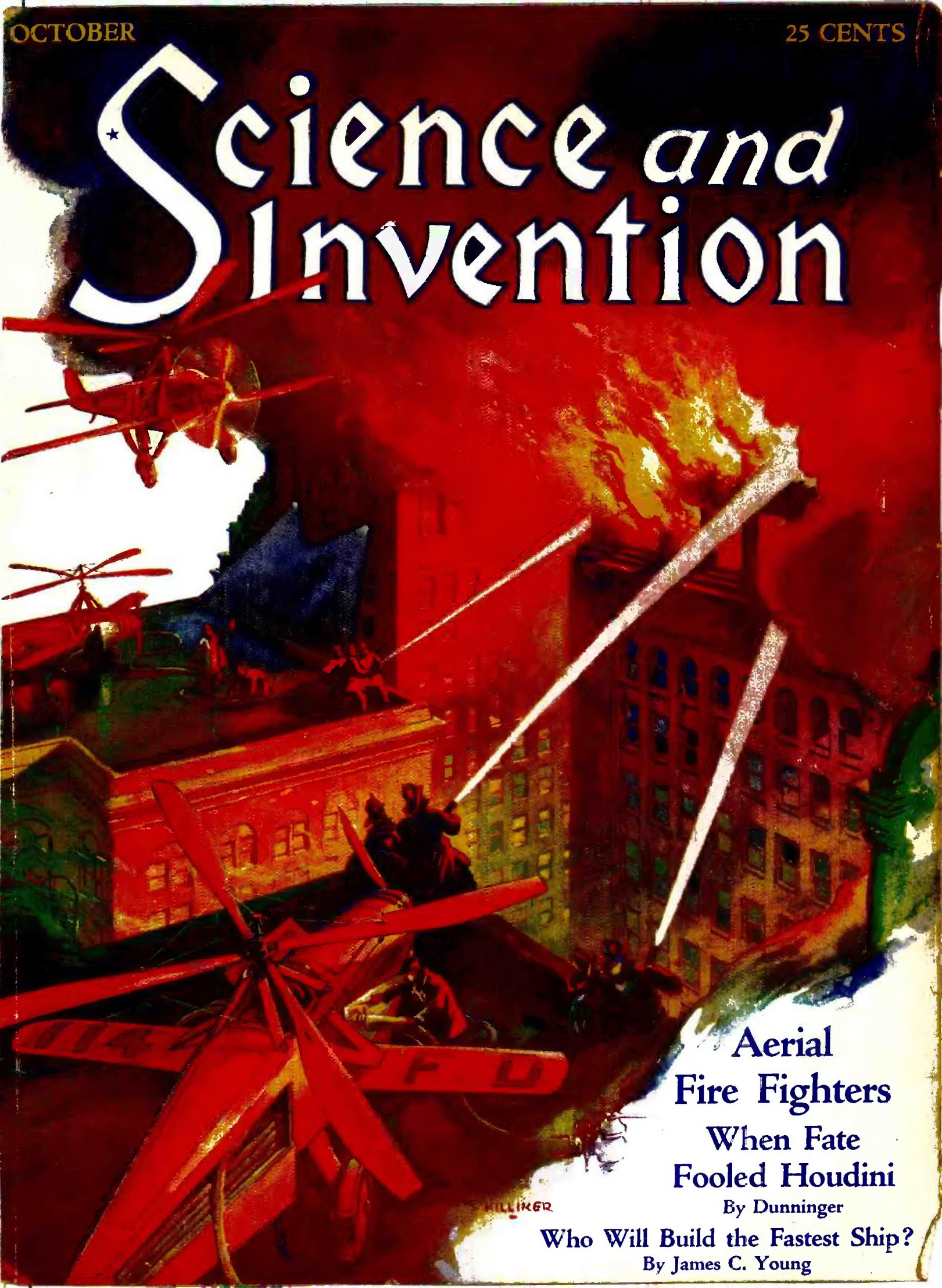
OCTOBER

25 CENTS

Science and Invention



Aerial Fire Fighters

When Fate Fooled Houdini

By Dunninger

Who Will Build the Fastest Ship?

By James C. Young

FREE This Great Money Saving WHOLESALE RADIO CATALOG

Send for it Today

17 YEARS of SUCCESS *Our Guarantee protects you*

The Little Salesman
Dealers Confidential Net Price List
ELECTRICAL RADIO AUTOMOTIVE and SPORTING EQUIPMENT
WHOLESALE RADIO CATALOG

NEW ENGLAND MILLS offers everything in Radio at Wholesale Prices that spell real savings! That's what you will find in this great Catalog just off the press, featuring Radio's newest creations in sets, kits, parts and supplies.

Everything in our catalog is backed by the guarantee of this old, stable concern and its vast resources, accumulated through seventeen years of faithful service to its customers.

Catalog also contains complete lines of electrical goods, tires, tubes, auto supplies, all kinds of sporting goods and hundreds of other items at wholesale prices.

for DEALERS, SET BUILDERS, AGENTS RADIO SERVICE & REPAIR MEN..

New England Mills Comp
851-53-55 WASHINGTON BLVD. CHICAGO, U.
ESTABLISHED 1912

Why Our Prices are Low

We are one of the largest outlets by mail to the trade. Our connections with many of America's leading factories enables us to buy on our own terms. Our cash resources makes it possible to command the very lowest prices from manufacturers—in most cases merely a small margin above actual manufacturing costs—and frequently at lower than cost. This in turn is reflected in the net **wholesale prices** we show in our catalog. We give our customers the benefit of our vast purchasing power.

All Radio Dealers Save Money

by trading with New England Mills. This saving applies to complete radio sets of every description, dynamic and magnetic speakers, A. C. and all other types of tubes, eliminators, batteries, radio cabinets—in fact, everything required by dealers for resale or servicing. Every dealer knows that by buying right he is in position to sell at **prices that meet all kinds of competition,** thereby increasing his profits and good-will.

Set Builders and Repair Men!

A tremendous amount of business will be done this season in rebuilding sets which users want to keep, and by modernizing old models. Our catalog contains everything required for this work. Besides, we have a supply of the **latest models** of **nationally renowned kits**—either knocked down or completely assembled chassis ready to install in table or console cabinets, all at **wholesale prices** that permit of excellent profits to you.

A.C. Electric Radios

Our new catalog contains a large selection of the finest A. C. Electric, 6, 7, 8 and 9 tube chassis and complete sets obtainable at the amazingly low prices we quote. Every modern radio improvement is embodied in these marvelous **electric radios.** All are sold by us with the **guarantee of satisfaction** backed by this 17 year old institution.

BATTERY SETS FOR UNWIRED HOMES

The vast number of rural communities with homes that are not wired for electric radios offer a tremendous market for battery sets, repairs and replacements. We have not overlooked this important field, as evidenced by the large stock of **batteries, eliminators, speakers, tubes, transformers, coils,** and all kinds of accessories needed for battery sets. These supplies include some of the **best known nationally advertised goods,** such as **Cunningham, Sonatron,** and **Arcturus tubes. Burgess batteries, Jewel instruments, Belden Products, Utah, Temple, Farrand** and other popular **dynamic** and **magnetic speakers.**

Send for Free Book *Now!*

Radio dealers, agents, set builders, service men, etc., cannot afford to be without the New England Mills catalog. It contains everything you need for a more profitable radio business. We maintain a complete radio service department, supervised by expert radio engineers who will help you with all your radio problems. All goods catalogued are stocked for immediate shipment. Write for this book today. It's FREE! Send request on your business stationery.

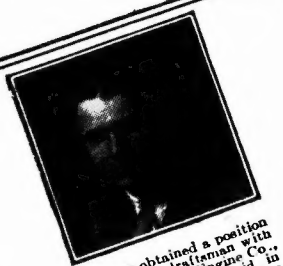
17 Years in Business

NEW ENGLAND MILLS COMPANY
851 Washington Blvd., Dept. 11, Chicago, Ill.

Who Else Wants A Good DRAFTING JOB?

"I am very well satisfied with the results of your and my efforts to get me a job in the drafting room of the Michelmann Steel Construction Co., Quincy. The gentleman there spoke highly of your correspondence course." Marcus Linse, Danvers, Ill.

"Thank you very much for your assistance, which enabled me to secure a position as draftsman with the Mississippi Valley Power Company." Lowell Perry, Fort Smith, Ark.



"I have obtained a position as a junior draftsman with the Muncie Oil Engine Co. I appreciate your aid in obtaining this position very much." Maurice N. Barcham, Muncie, Ind.

"I think that the letter that you sent to my employer had great weight in his decision to employ me. I like the position that I have very well." William F. Olegsky, Shawnee, Kansas

During the past few months we have placed HUNDREDS of former clerks, mechanics and beginners in fine positions—with Contractors, Architects, and in big manufacturing plants. (Read a few typical letters above.)

These men came to us because they were dissatisfied with their earnings and with their future prospects. Now they are doing work they like—making good money—**and have a real chance to advance still farther.**

If you are trying to solve a similar personal problem, we invite you to get in touch with us. We'll be glad to tell you how you, too, can get a well-paid Drafting job—without risking a penny of your money.

Why we recommend DRAFTING

We believe it will pay you to investigate Drafting. Many of our most successful Contractors and Engineers STARTED in the Drafting room. That opportunity to get to the top—to meet big men—to take charge of important projects is the best feature of Drafting.

The work is interesting and pleasant. The hours are easy. You work with a wonderful bunch of fellows. Salaries range from $35 to $50 a week for beginners, up to $100 and more a week for experienced Draftsmen.

One man puts it this way: "I really didn't know exactly what Drafting was. I thought it required artistic talent and a high school or college education. I was much surprised to find it wasn't any harder to learn than my former trade of plastering."

And Now— Jobs for STUDENTS!

For the past five years the American School has provided a free Employment service for all who **completed** this home-training in Drafting. Now we have found a way to place all STUDENTS when only half-way through the course. Mail coupon for complete information of this remarkable service.

PROMOTION For Office and Factory Workers

If you're a shop man you can realize that the man who **makes** the plans is a step above the workman who **follows** the blue-print. If you're a clerk you know that copying figures all day cannot compare in salary or responsibility with creating designs and plans of buildings, machinery, or the products of industry.

How are you going to get away from routine work—how can you even get a $10 a week increase in pay—how can you get into a line where there is a real future? Let us show you that Drafting offers you all these things—in less time, and with less effort than any other line.

FREE Drafting Book

Over 70,000 fine Drafting positions have been advertised in the past year. Electrical, Architectural, Mechanical, Structural and Automotive lines, all need Draftsmen. Here is one of the biggest fields you can get into. Get our free 36-page book and see how easily you can learn and how we help you get a well-paid position as soon as you are ready for it.

The American School **Dept. D-753**
Drexel Ave. & 58th St., Chicago

Please send FREE and without obligation 36-page Drafting Book and your offer to help me get a Drafting job when only half-way through the course.

Name.....Age.....

St. No.....

City.....State.....

The American School

Dept. D-753, DREXEL AVE. & 58th ST., CHICAGO

This Issue Contains These UP-TO-THE-MINUTE *Articles by* WELL-KNOWN *Authors*

General Science

What Price Ship Speed?..... 484
Editorial 488
Aerial Fire Fighters..... 490
Inside the Graf Zeppelin..... 491
New Hudson River Bridge..... 492
Engineering Taught by Movies..... 492
Who Will Build the Fastest Ship?..... 494
By James C. Young
Scientific Progress..... 496
New Thrills by Science in Sports..... 498
Can You Solve These Scientific Puzzles?..... 500
By Ernest K. Chapin
Do You Resemble the Typical American Genius?.. 501
Would You Believe It?..... 502
Noah's Ark Lives Again for the Movies..... 503
By Edwin Schallert
When Fate Fooled Houdini..... 504
By Dunninger
Time and Labor Savers..... 506
Coal Miner's Job Safer Than Yours!..... 507
By Alvin F. Harlow
Playing With Death..... 508
By N. A. Foazrim
Dust! 510
Light Controls Machine..... 511
Rotary Auto Engine..... 511
Making Sound Behave!..... 512
By John De Quincey
Magic—A Monthly Feature..... 514
By Dunninger
Germany's 120-Passenger, Twelve-Engined, Trans-oceanic Air Liner..... 515
25,000 Miles Without Landing!..... 516
A Merry-Go-Round Demonstrates Einstein Theory 517
By Dr. Donald H. Menzel
Grow New Plants Without Any Seeds..... 518
By Dr. Ernest Bade
What Our Readers Think..... 532
Scientific Humor..... 538
Latest Patents..... 539
The Oracle..... 540
Financial Information..... 547
By Alfred M. Caddell

Aviation

Aerial Fire Fighters..... 490
Inside the Graf Zeppelin..... 491
Germany's 120-Passenger, Twelve-Engined, Trans-oceanic Air Liner..... 515
25,000 Miles Without Landing!..... 516
A New German Glider..... 525

Chemistry and Electricity

Dust! 510
Light Controls Machine..... 511
Wrinkles and Recipes..... 530

Home Movies

Engineering Taught by Movies..... 492
Movie Projector for Your Library..... 511
"Home Movies"—A Monthly Department..... 521
By Don Bennett

Automotive

Rotary Auto Engine..... 511
Motor Hints..... 520
By George A. Luers

Radio

Attractive Dynamic Speaker Cabinet..... 534
By A. Brams
Soldering Iron Control for Delicate Work..... 534
New Nine-Tube A. C. Receiver..... 535
New Radio Devices..... 536
Radio Oracle..... 537

How to Make It

How to Have Talking Movies..... 522
Home Wood Turning Provides Artistic Lamps and Candlesticks 523
Making an Air Lift Pump..... 524
How to Make It Department..... 526
Hints for the Home Workshop..... 528
Wrinkles and Recipes..... 530

NEXT MONTH

Solving Traffic Problems From the Air

Several ingenious schemes will be described whereby both town and country traffic problems may be readily solved by aerial observation.

With the Aviation Inventors

You will be surprised at just what the patent office records reveal when it comes to airplane and dirigible inventions.

A Flying Hangar for Airplanes

Traffic in the air is growing very rapidly and even now our military authorities are experimenting with a flying hangar for planes.

Should I Buy an Oil Burner?

An informative illustrated article on oil burners for the home, written by an expert.

Are All Mediums Fakes?

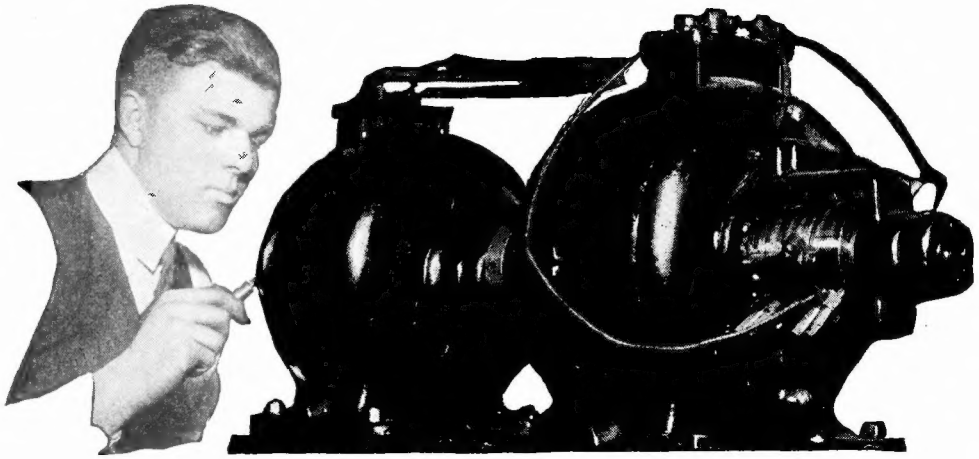
The author of a very interesting article in the next issue of this journal tells of the many mediums he investigated and their clever trickery.

VOL. XVII. Whole Number 198 Oct., 1929, Number 6

SCIENCE AND INVENTION. Published monthly by Experimenter Publications, Inc., at 184-10 Jamaica Ave., Jamaica, N. Y. Entered as second class matter, at the Post Office at Jamaica, N. Y., under the Act of March 3, 1879. Title registered at the U. S. Patent Office.

Copyright, 1929, by Experimenter Publications, Inc. The contents of this magazine must not be reproduced without giving full credit to the publication.

Subscriptions: $2.50 per year in U. S. and possessions; Canada and foreign countries, $3.00 a year. Mackinnon-Fly Publications. Experimenter Publications, Inc. Novel Magazines Corp. Executive and Editorial Offices, 381 Fourth Avenue, New York City, N. Y.



Amazingly Easy Way to get into ELECTRICITY

Don't spend your life waiting for $5.00 raises in a dull, hopeless job. Now . . . and forever . . . say good-bye to 25 and 35 dollars a week. Let me show you how to qualify for jobs leading to salaries of $50, $60 and up, a week, in Electricity—NOT by correspondence, but by an amazing way to teach, that makes you a practical expert in 90 days! Getting into Electricity is far easier than you imagine! Act now, today!

Learn Without Books in 90 DAYS

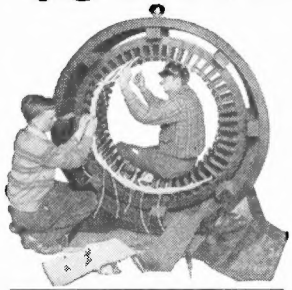
LACK of experience—age or advanced education bar no one. I don't care if you don't know an armature from an air brake—I don't expect you to! I don't care if you're 16 years old or 40—it makes no difference! Don't let lack of money stop you. Most of the men at Coyne have no more money than you have.

Railroad Fare Allowed

I will allow your railroad fare to Chicago, and if you should need part-time work I'll assist you to it. Then, in 12 brief weeks, in the great roaring shops of Coyne, I train you as you never dreamed you could be trained . . . on the greatest outlay of electrical apparatus ever assembled . . . costing hundreds of thousands of dollars . . . real dynamos, engines, power plants, autos, switchboards, transmitting stations . . . everything from doorbells to farm power and lighting . . . full-sized . . . in full operation every day!

No Books—All Actual Work

No books, no baffling charts . . . all real actual work . . . building real batteries . . . winding real armatures, operating real motors, dynamos and generators, wiring houses, etc., etc. That's a glimpse of how we make you a master practical electrician in 90 days, teaching you far more than the average ordinary electrician ever knows and fitting you to step into jobs leading to big pay immediately after graduation. Here, in this world-famous *Parent school*—and nowhere else in the world—can you get such training!



Prepare for Jobs Like These

Here are a few of hundreds of positions open to COYNE-trained men. Our free employment bureau gives you lifetime employment service.

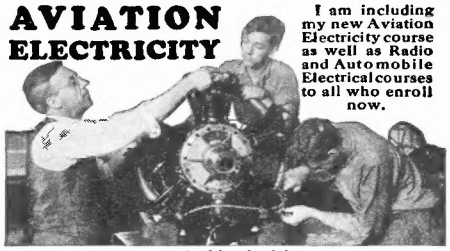
Armature Expert	up to $100 a Week
Substation Operator	up to $65 a Week
Auto Electrician	$60 a Week and up
Inventor	Unlimited
Maintenance Engineer	up to $100 a Week
Service Station Owner	$60 a Week and up
Radio Expert	$60 a Week and up

Jobs, Pay, Future

Don't worry about a job, Coyne training settles the job question for life. Demand for Coyne men often exceeds the supply. **Our employment bureau gives you lifetime service.** Two weeks after graduation, Clyde F. Hart got a position as electrician with the Great Western Railroad at over $100 a week. That's not unusual. We can point to Coyne men making up to $600 a month. $60 a week is only the beginning of your opportunity. You go into radio, battery or automotive electrical business for yourself and make up to $15,000 a year.

AVIATION ELECTRICITY

I am including my new Aviation Electricity course as well as Radio and Automobile Electrical courses to all who enroll now.



Students wiring and checking ignition on one of the late type Radial Aircraft Engines in our aviation department.

Get the Facts

Coyne is your one great chance to get into electricity. Every obstacle is removed. This school is 30 years old—Coyne training is tested—proven beyond all doubt—endorsed by many large electrical concerns. You can find out everything absolutely free. Simply mail the coupon and let me send you the big, free Coyne book of 150 photographs . . . facts . . . jobs . . . salaries . . . opportunities. Tells you how many earn expenses while training and how we assist our graduates in the field. This does not obligate you. So act at once. Just mail coupon.

Get this FREE Book

Mr. H C. LEWIS, Pres.
COYNE ELECTRICAL SCHOOL Dept. 79-27
500 S. Paulina St., Chicago. Ill.

Dear Mr. Lewis: Without obligation send me your big free catalog and all details of Railroad Fare to Chicago, Free Employment Service, Aviation Electricity and Automotive Electrical Courses and how I can "earn while learning."

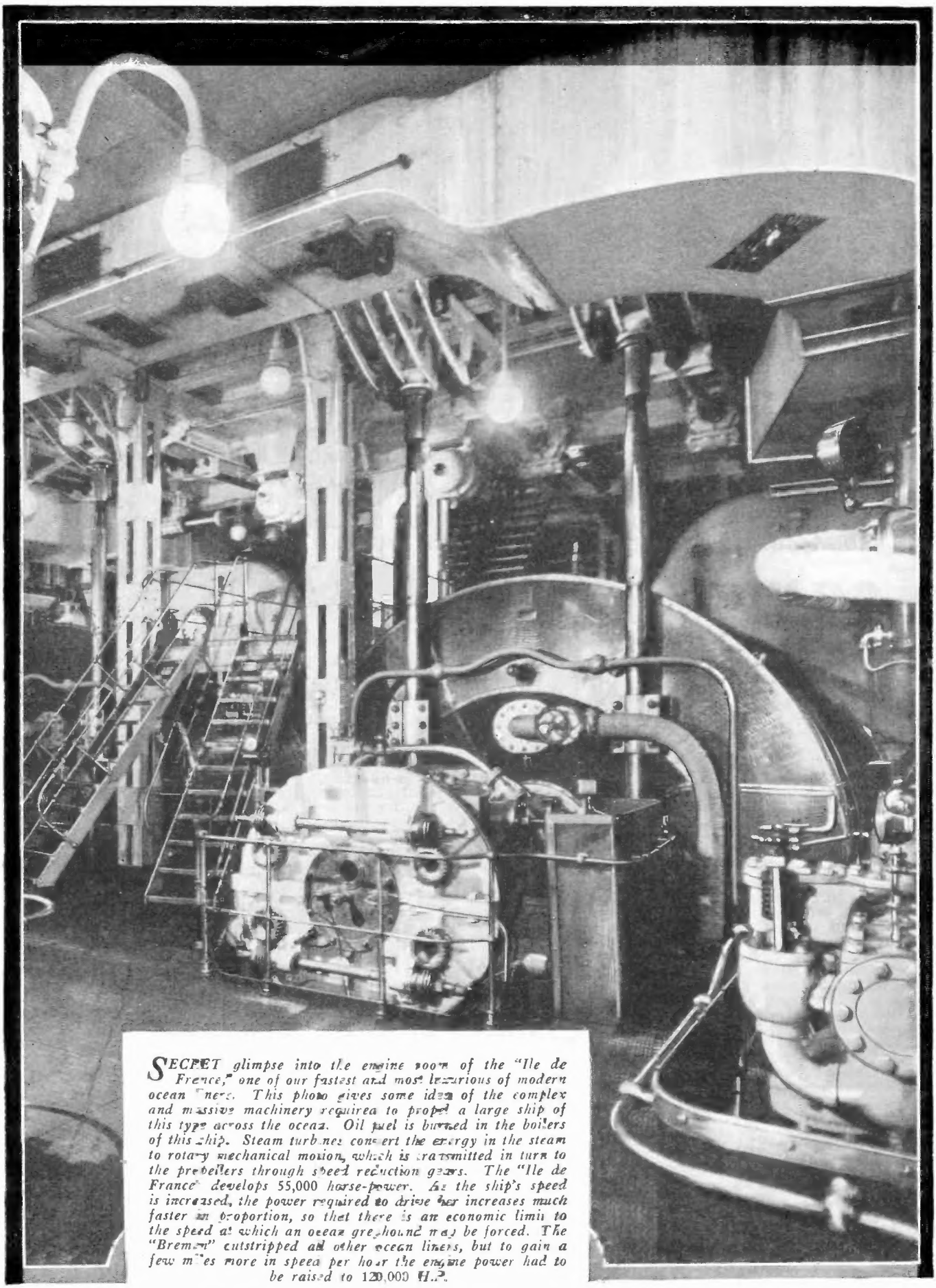
*Name*_____

*Address*_____

*City*_____ *State*_____

COYNE ELECTRICAL SCHOOL
H. C. LEWIS, Pres. ***Established 1899***
500 South Paulina Street **Dept. 79-27, Chicago, Illinois**

What Price Ship Speed?



SECRET glimpse into the engine room of the "Ile de France," one of our fastest and most luxurious of modern ocean liners. This photo gives some idea of the complex and massive machinery required to propel a large ship of this type across the ocean. Oil fuel is burned in the boilers of this ship. Steam turbines convert the energy in the steam to rotary mechanical motion, which is transmitted in turn to the propellers through speed reduction gears. The "Ile de France" develops 55,000 horse-power. As the ship's speed is increased, the power required to drive her increases much faster in proportion, so that there is an economic limit to the speed at which an ocean greyhound may be forced. The "Bremen" outstripped all other ocean liners, but to gain a few miles more in speed per hour the engine power had to be raised to 120,000 H.P.

$350 a month

"I feel proud of my success in Radio to date. My profit during the last two months amounts to $700. I am making good and I have not finished my N. R. I. course yet. I am grateful for your training and co-operation to date and look forward to still bigger success when I graduate."

Clarence Heffelfinger, Temple, Penna.

$500 a month

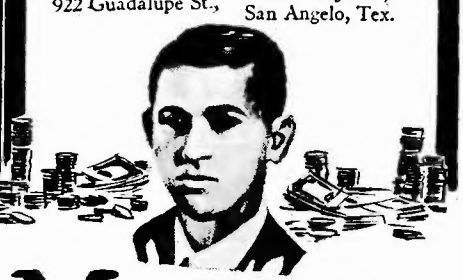
"When I enrolled with the N. R. I., I was a motorman on a trolley car. Now I have a fine, fast-growing Radio business. When only half way through the course started bringing in extra money. I made $420 in my spare time. Now I have a bank account of $2800 and about $300 worth of stock. It has all come from Radio since graduating less than six months ago. I cannot begin to express my thanks to you and all those connected with N. R. I. for what you have done for me."

Richard Butler, 3535 Sheffield St., Philadelphia, Pa.

$450 a month

"In addition to my regular work in what I believe to be the largest and best equipped Radio Shop in the Southwest, I am now operating KGFI. I am proud of the fact that I installed and put KGFI on the air without help of anyone except the N. R. I. I am averaging $450 per month."

Frank M. Jones, 922 Guadalupe St., San Angelo, Tex.



READ *what* Big Money *my men make in* RADIO

$350, $450, $500 a month. That's making real money. What business other than Radio offers such opportunities after six to twelve months training? None that I know of. More proof—last year electricians, farmers, mechanics, clerks, railroad men, bookkeepers, preachers, doctors, and men from 78 other trades and professions enrolled with me to prepare for the Radio field.

Big Growth Making Many Big Jobs

A WONDERFUL business, you will say, to make men trained for other fields, give them up for Radio. Yes, but they had their eyes wide open. They know what you and I know—that big growth makes big jobs and many opportunities to earn big money. Heffelfinger, Jones, and Butler couldn't make anything like this money before, although they probably worked just as hard—maybe harder. Trained men are needed for the big jobs the amazing growth of Radio is creating.

Salaries Up To $250 a Week

WHY go along at $25, $30, $35 a week when the good Radio jobs pay $50 to $250 a week? Cut loose from drudgery, small pay, no-future jobs. Get into a live-wire field that offers you a real chance. You don't need a high school or college education to become a Radio Expert. Many of my most successful graduates didn't finish the grades.

Practical Experience With Course

I GIVE you six big outfits of Radio parts. With them you can build and experiment with one hundred different circuits—learn the "how" and "why" of practically every type of set made. This makes learning easy, interesting, fascinating, your training complete. Nothing else equals my method.

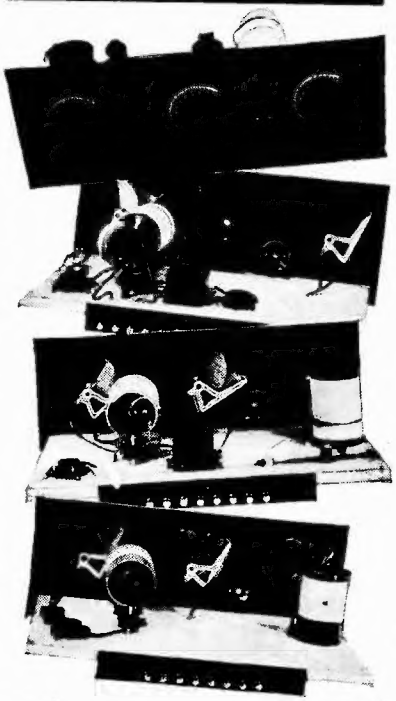
TELEVISION also Included

YOUR knowledge of Radio will be right up to the minute with Radio's progress and inventions when you take my training. Television, the new field for Radio experts, is included. Not one system for sending and receiving pictures by Radio, but all of them—Jenkin's, Cooley's, Bell's, Baird's, Belin's, Alexanderson's.

Television can easily and quickly become as large as the whole Radio industry is today Broadcasting stations will soon need trained men, so will manufacturers for the designing and building of sending and receiving sets. It won't wait for you. Get ready quick.

THIS IS RADIO'S BIGGEST YEAR

I GIVE YOU THE RADIO PARTS FOR A HOME EXPERIMENTAL LABORATORY



WITH THEM YOU CAN BUILD 100 CIRCUITS. 4 YOU BUILD ARE SHOWN HERE. MY BOOK EXPLAINS THIS PRACTICAL FASCINATING WAY OF LEARNING RADIO

Get a copy Free

I Will Train You *at* Home in Your Spare Time

NO NEED to leave home. Hold your job, give me one-half to one hour a day of your spare time. In six to twelve months you can be a trained Radio Expert, ready to step into a new job with a real future.

$10 to $30 a Week While Learning

MANY of my students make $10, $20, $30 a week extra while learning. I teach you to begin making money shortly after you enroll. G. W. Page, 1807 21st St., Nashville, Tenn., made $935 in his spare time.

Money Back If Not Satisfied

I KNOW the kind of training you need. I have put hundreds of men and young men ahead. I am so sure that I can satisfy you too that I will agree to refund your money if you are not satisfied when you complete my course.

Find Out What Radio Offers You

MY 64-page book explaining where the big jobs are and what you can make is FREE. Mail coupon. No obligation.

Address: Dept. 9XT
J. E. Smith, Pres.,
Nat'l Radio Institute,
Washington, D. C.

Send this Coupon

J. E. Smith, *President*,
Dept.. 9XT National Radio Institute,
Washington, D. C.

Dear Mr. Smith:—Send me your book. I want to know about the opportunities in Radio and your practical method of teaching at home with six big outfits of Radio parts. This request does not obligate me to enroll.

Name ..... *Age*.....

Address .....

City ..... *State*.....

New Handibooks for Every Home

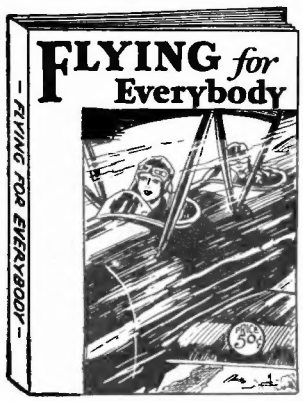
Get Them From Your Newsdealer or Fill Out and Mail Coupon Below

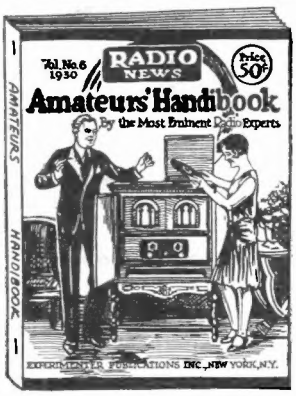
RADIO TROUBLE FINDER 1930 Edition

Ever have your radio fail when a big program was on? That's when the New Radio Trouble Finder is worth its weight in gold! It tells you what to do, and do quickly in order to find and repair the trouble. 64 pages in easy-to-understand language and non-technical diagrams. Every home should own a copy. Price postpaid only **25c**

FLYING FOR EVERYBODY

Everyone interested in aviation should own this most helpful book. Includes the fundamental principles of flying; how to learn to fly; how to tell when a plane is safe; passenger rates on newest air routes, etc. In fact, it might well be called a complete encyclopedia on Aviation. 96 pages, fully illustrated. Printed in the large 9 by 12 inch size, with beautiful colored cover. Price postpaid only **50c**





RADIO AMATEUR'S HANDIBOOK 1930 Edition

Sometimes called the Radio Amateur's Bible. Includes 10 How-to-Build articles, with complete instructions and diagrams; new radio wrinkles, DX hints, data on the new tubes, answers to AC problems, and helpful, money-saving ideas for the radio service man. 96 illustrated pages. Large 9 by 12 inch size. Beautiful colored cover. Price postpaid **50c**

HOW TO WIN AT BRIDGE
by Wilbur C. Whitehead

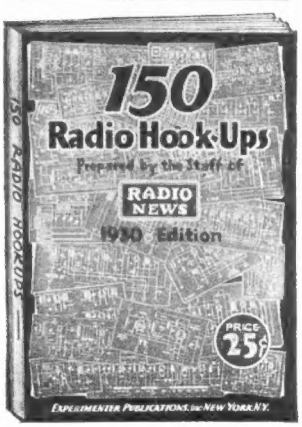
The world-famous Bridge authority's newest book. Tells how to play both Auction and Contract Bridge TO WIN! Complete rules of play and methods of scoring for both Auction and Contract Bridge. Contains 500 hands to bid and play, with complete solutions and analyses in back of book. The biggest 50c worth ever offered to Bridge fans. Printed in 2 colors. Hearts and diamonds shown in red throughout.. 96 pages. Large 9 by 12 inch size. Beautiful colored cover. Price postpaid only **50c**

1001 RADIO QUESTIONS AND ANSWERS 1930 Edition

If you own a radio, you need this book. Everything you want to know about radio is in it, from "How to Kill Outside Radio Noises" to a clear description of the newest tubes and how to use them. If you have a question on radio, here is your answer and a thousand more. 96 illustrated pages. Large 9 by 12 inch size. Beautiful colored cover. Price postpaid only **50c**

POPULAR MAGIC AND CARD TRICKS 1930 Edition

Hundreds of parlor tricks and games described and illustrated so that anybody can do them. Always good for an evening's entertainment. Mystify your friends, charm the ladies. 96 pages. Large 9 by 12 inch size. Beautiful colored cover. Price postpaid only **50c**



150 RADIO HOOKUPS 1930 Edition

All the newest hook-ups, described with complete diagrams. Every radio fan and set-builder should own a copy for ready reference. Includes crystal circuits, single circuit detectors, audio and RF amplifier circuits, superheterodynes and numerous AC and DC receiver circuits. 64 pages, with beautiful colored cover. Price postpaid **25c**

We accept stamps for all orders under $1.

Simply Clip and Mail This Coupon With Your Order.

EXPERIMENTER PUBLICATIONS, Inc.
Dept. 2510aa, 381 Fourth Ave., New York, N. Y.

Gentlemen: I enclose ....., for which please send me (amount here) postpaid the following:

Check Ones You Want	☐ Radio Trouble Finder	☐ Flying for Everybody
	☐ Amateur's Handibook	☐ Popular Magic and Card Tricks
	☐ 1001 Questions & Ans.	☐ How to Win at Bridge
	☐ 150 Radio Hook-ups	

Name.....

Street Address.....

City.....State.....

Now First Published! *A Completely New* ENCYCLOPÆDIA BRITANNICA

NEW in plan and purpose—entirely recast from cover to cover—the *new* Fourteenth Edition of the Encyclopaedia Britannica is ready. This is the superb "humanized" Britannica which has captured the attention of the whole civilized world.

Three years of intensive effort—the co-operation of 3,500 of the world's foremost authorities—the expenditure of more than $2,000,000 before a single volume was printed—these are merely a few high lights in the preparation of the *new* Fourteenth Edition.

This handsome bookcase table, made of genuine Brown Mahogany, is included with every set of the new Britannica.

The Last Word in Encyclopaedia Perfection

This *new* Britannica immediately takes its place as the one pre-eminent American work of reference—the last word in encyclopaedia perfection.

Never has there been assembled together in one enterprise such a wealth of learning as is represented by the 3,500 builders of this great temple of knowledge. *All* the universities, *all* the learned professions, *all* the great industries, *all* the pastimes have contributed to the mighty sum.

Knowledge for All

It is a law library for the lawyer, a medical digest for the doctor, a universal history for the historian, a commercial university for the business man—and a compendium of all the arts and sciences for the average reader.

Here is "the cosmos between covers." The whole whirling universe is brought within your grasp, obedient to your hand.

Nothing is too profound to baffle it, and nothing too familiar to escape its informing touch. And on every subject it speaks with the same finality and authority.

All the World's Treasures of Art and Illustration

Among the many new features that will astonish and delight everyone that turns these pages is the wealth and beauty of the illustrations. This feature alone marks a tremendous advance. All the world's treasures of art and photography have been laid under tribute to adorn and illuminate the text.

"The most exciting book of 1929," asserts a leading critic, and the whole world is echoing that verdict.

This is a Britannica year! Here is your opportunity to join the thousands who will buy this new edition, now, while it is new—fresh from the presses. You owe it to yourself to learn further details regarding this magnificent series of volumes.

Note these facts

Cost More Than $2,000,000.

Over 15,000 Superb Illustrations.

Greatest Knowledge Book Ever Produced.

Written by 3,500 of the World's Most Eminent Authorities.

Remember—this is a new book. Only a small amount of text—material which could not be improved in any way—has been retained from previous editions.

Extremely Low Price

And due to the economies of mass production, the price is extremely low—the lowest in fact at which a completely new edition has been offered for two generations! Easy payments, if desired—a deposit of only $5 brings the complete set with bookcase table to your home.

Send for FREE Booklet

We have just prepared a handsome new 56-page booklet containing numerous color plates, maps, etc., from the new edition and giving full information about it, together with full details of bindings, the present low prices and easy payment plan. We want you to have a copy free and without the slightest obligation.

The demand is great—you should act promptly if you are interested in owning a set of the first printing on the present favorable terms. Just fill in the handy coupon and mail it today.

MAIL this Coupon TODAY

S19-A1

ENCYCLOPAEDIA BRITANNICA, Inc.
342 Madison Avenue, New York City.

Please send me by return mail, without any obligation on my part, your 56-page illustrated booklet describing the *new* Fourteenth Edition of the Britannica together with full information concerning bindings, low price offer and easy terms of payments.

Name .....

Address .....

City ..... *State* .....

VOLUME XVII
WHOLE NO. 198

Science and Invention

OCTOBER, 1929
NUMBER 6

ARTHUR H. LYNCH, Editorial Director.

H. WINFIELD SECOR, E.E., Managing Editor.
JOSEPH H. KRAUS, Field Editor.
T. O'CONOR SLOANE, Ph.D., Associate Editor.

AUGUSTUS POST, Aviation Editor.
ALFRED M. CADDELL, Financial Editor.
WILLIAM F. CROSBY, Marine Editor.

"Those Who Refuse to Go Beyond Fact Rarely Get as Far as Fact" - - - - - *HUXLEY*

TRANSATLANTIC TRAVEL

RECORDS for crossing the Atlantic are being broken almost as impressively as flight endurance records. The following list indicates the actual manner in which this has been brought about since Christopher Columbus blazed the trail.

1492—Columbus sailed from Palos, Spain, to the Bahamas in 71 days.

1819—The *Savannah*, an American-built steamer of 350 tons, crossed from Savannah to Liverpool in 26 days, being the first steamer to make the Atlantic passage.

1838—The *Great Western* crossed from Bristol, England, to New York in 13½ days. Subsequently she made a record of 10 days, 10 hours and 15 minutes.

1866—The *Scotia* made the run between New York and Queenstown in 8 days, 2 hours and 48 minutes.

1882—The *Alaska*, New York-Queenstown, 6 days, 18 hours, 37 minutes.

1891—The *Majestic*, New York-Queenstown, 5 days, 18 hours, 8 minutes.

1910—The *Mauretania*, New York-Queenstown, 4 days, 10 hours, 41 minutes.

1927—Col. Lindbergh flew 3,600 miles from New York to Paris in 33 hours, 29 minutes, 30 seconds.

September, 1928—The *Mauretania* crossed from Cherbourg to New York in 5 days, 2 hours and 34 minutes, beating her record of August, 1924, of 5 days, 3 hours and 20 minutes.

1928—The airplane *Bremen* crossed westward from Ireland to northeast coast of Province of Quebec in 36½ hours.

1929—The steamship *Bremen* crossed from Cherbourg to New York in 4 days, 17 hours and 42 minutes.

1929—The *Graf Zeppelin* flew from Lakehurst to Friedrichshafen in 55½ hours (4,200 miles).

In the conquering of the Atlantic, and the speeding up of communication between this country and Continental Europe, a number of romantic characters stand out in great relief. Possibly the character most in the public eye in this connection at the present moment is Capt. Hugo Eckener, who, if all goes well with him, will be just returning to Lakehurst as the magazine carrying this editorial reaches the newsstands.

It is, perhaps, the natural working of what many of us consider to be an unjust fate that much of the hardship and study and planning for a trip such as Commander Eckener's is borne by the ground crew. Walter Hinton, who, by the way, made the first transatlantic air crossing in the airplane *NC-4*, is responsible for the statement that "for every job in the air forty people are required on land." From this statement we get some idea of the immensity of the work entailed in preparation for a transatlantic airplane flight, to say nothing of the work and planning necessary for the flight of a dirigible such as the *Graf Zeppelin* or the two English air Leviathans which will soon visit this country. Much of the glamour of the conquest is centered upon the captains and the pilots under whose command these wonderful results are accomplished, and we cannot refrain in passing from saluting the men ashore who stand behind every one of these successful undertakings.

Arthur H. Lynch

Editorial Director

SCREEN GRID RADIO

WHOLESALE PRICES

FREE RADIO CATALOG

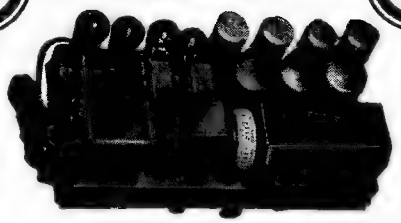
HERE is a book it will pay you to get—148 pages of desirable radio merchandise—everything new right up-to-the-minute of going to press—at prices that will make you wonder how we can possibly offer such bargains. Wholesale prices prevail throughout. From the first page to the last this book is crowded with values that will please and astound you—every radio need and requirement fulfilled in this greatest of all Radio Books.

Standard Sets as low as

$15.95

Marvelous offerings in new, Humless, Screen Grid A. C. all-electric and battery operated sets; a wide range of beautiful consoles, from the small table model types to the most ornate and artistic of radio furniture; dynamic speakers of tremendous volume and richest tone; accessories, parts and kits in wide variety—in fact, everything that is standard, as well as everything that is new, in Radio. Get this book *today!* Supply your every Radio need at rock-bottom wholesale prices, and pocket the saving. Such startling values have never before been offered at like prices.

Write for This Catalog Now!



The New Screen Grid Receivers

The outstanding Screen Grid Receiver of the year featuring advanced engineering practices and a new perfection in circuit design—that is establishing a new standard in radio performance.

Humless

The use of the new heater type tubes assures freedom from hum and all extraneous noises assuring unusual tone quality.

A. C. Operated

Practical A. C operation assures consistent performance operates directly on 110-125 volt, 50-60 cycle A. C.

Power Detector

A tuned detector stage in keeping with modern radio engineering imparts unusual power to the receiver.

"245" Push Pull

The use of two "245" super power tubes assures faithfulness in reproduction without danger of overloading.

Screen Grid Tubes

Three screen grid tubes in this famous chassis assure extreme sensitiveness and remarkable distance range.

Super-Sensitive

Power detector coupled with Screen Grid R. F. efficiency imparts unusual sensitivity to the circuit assuring extreme distance range.

Dynamic Tone

Two stages of audio frequency the last employing two "245" power tubes with oversize transformers assures finest tone quality.

Tremendous Volume

Perfection in audio circuit design makes possible tremendous undistorted volume from a whisper to the full blare of an orchestra.

CHICAGO SALVAGE STOCK STORE

World's Largest Radio Store

509 So. State St. Dept. 128 Chicago, Ill.

Aerial Fire Fighters

How Airplanes Will Increase Speed and Efficiency in the Operation of Fire Departments

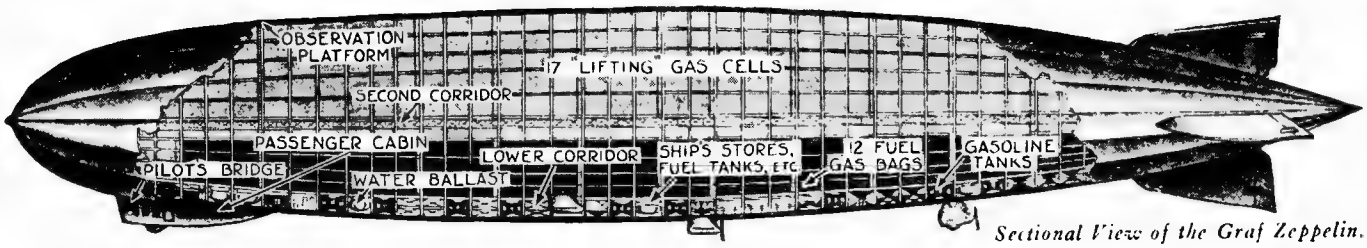
By John Croller

The illustration above and at right shows how the aerial fire-fighting planes would attack a skyscraper fire. The plane would fly to the scene of the conflagration and land on the roof of the nearest building. The suction hose will be attached to the building's standpipe and one or more hoses attached to the delivery pipe of the pump, the pump acting as a "booster" and serving to throw streams of water several hundred feet beyond the range ordinarily possible.

OUR front cover and the accompanying illustration also illustrate the very latest idea for fighting fires with the aid of airplanes. The airplane shown in the accompanying picture is a special new form of plane, known as the *autogiro*. The outstanding feature of this new type of aircraft is that it can ascend or descend almost vertically on the order of a helicopter. One of our leading fire-fighting experts, a member of the New York City Fire Department, recently declared that the city is on the verge of adopting the airplane as a part of its regular fire-fighting equipment.

The accompanying picture shows how the autogiro form of plane could be arranged to carry hose, as well as a fire pump and accommodations for several firemen. A special clutch would permit the airplane engine to be connected with the water pump, this pump taking water from a standpipe terminating at the building roof. Where insufficient pressure of water was available to fight fires in tall buildings in the vicinity, the pump on the airplane would act as a booster and enable the firemen to direct streams of water into much higher buildings in the vicinity. Another distinct advantage of the airplane as one of the important links in our modern fire-fighting equipment lies in its great speed. Imagine how much faster a fleet of fire-fighting planes could travel several miles to a large conflagration compared to a number of automobile fire engines making their way through the crowded streets of a large city like New York or Chicago. These fire-fighting planes would carry, in addition to hose and pump, a goodly number of hand-operated portable fire extinguishers, axes, scaling ladders and other equipment which readily permits its crew of firemen to put out any ordinary blaze. The cost of these fire-fighting planes would be quite reasonable, considering the great advantage of speed with which these planes could travel to a fire. These planes can also land on the water, if they are designed as amphibians, and in this capacity they will prove invaluable.

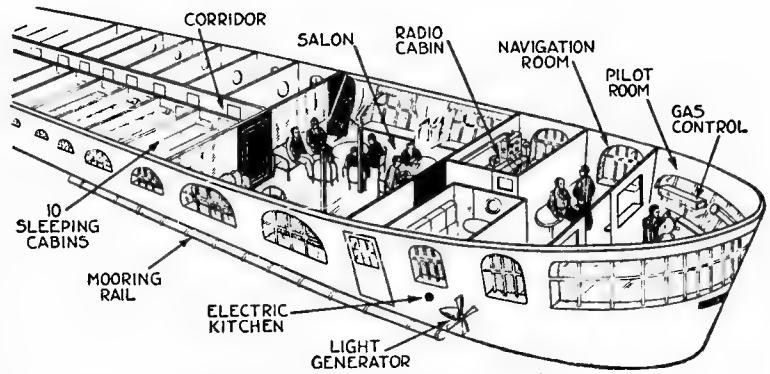
In fact it would not be unreasonable to assume that in ten to fifteen years from now a major part of our fire-fighting equipment may have "sprouted wings." As our cities keep expanding and our suburban sections multiplying, the principal desideratum will be speed, and the airplane seems to be the best answer to that problem. For the small town fire-fighting equipment, the airplane will soon prove indispensable.



Sectional View of the Graf Zeppelin.

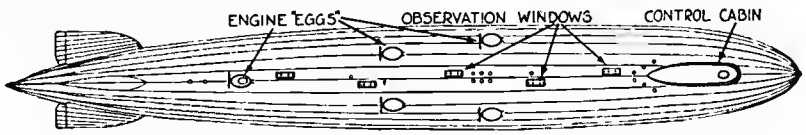
INSIDE THE Graf Zeppelin

THE sectional view of the *Graf Zeppelin*, shown herewith, gives some idea of the complicated internal structure of this large "grown-up" balloon, which carries two kinds of gas, hydrogen for lifting her huge bulk and Blau gas as fuel for her five Maybach engines. Gasoline is also carried as auxiliary fuel for the engines, but only a small quantity of this fuel is carried. A simple valve enables the engineers to instantly switch the engines from Blau gas fuel to gasoline, and vice versa. The Blau gas is carried in twelve bags along the bottom of the frame, just under the hydrogen "lifting" cells or bags. The *Graf Zeppelin* carried 22 passengers and a crew of 40 men, including three pilots and three navigators, when she left Lakehurst, August 8.



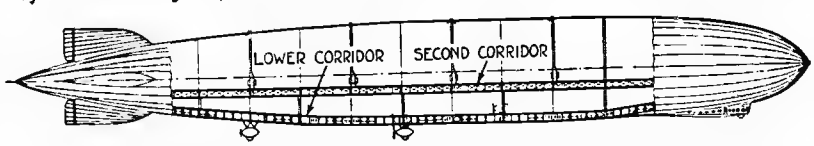
Where the officers and passengers live.

The passenger cabins, dining salon, radio room as well as the "bridge" are shown above. In stormy weather the commanding officer spends many hours on constant watch, together with his officers, at this important key position on the dirigible, where mechanical and electrical means are provided for opening and closing gas valves, ballast dumps, etc.

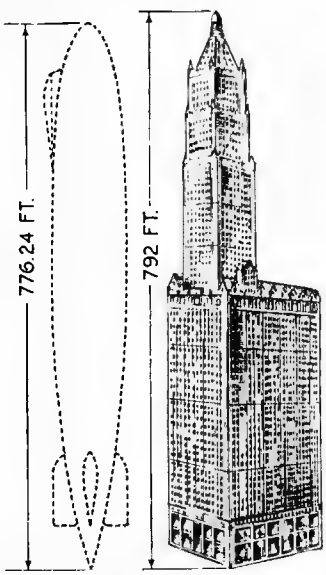


Unusual "bottom" view of modern dirigible, showing windows.

How the bottom of a modern dirigible such as the *Graf Zeppelin* looks is illustrated above; note trapdoor for lowering ropes and also the observation windows.



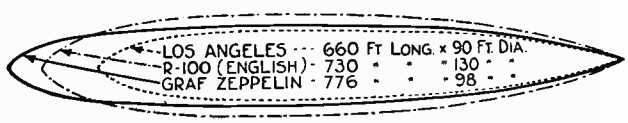
Note second corridor in Graf Zeppelin, for inspection purposes.



Graf Zep compared to Woolworth Building.

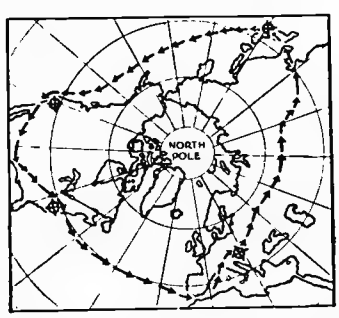
To inspect the 17 "lifting gas" cells, also the 12 fuel gas bags, the designers of the *Graf* provided a lower and a second corridor or catwalk.

If you saw the *Graf Zeppelin* stood up on its tail alongside the Woolworth Building, it would reach nearly up to the dome of that famous edifice. Imagine the bending and twisting stresses in a "balloon" of this size.



Los Angeles, R-100 and Graf Zeppelin compared as to size.

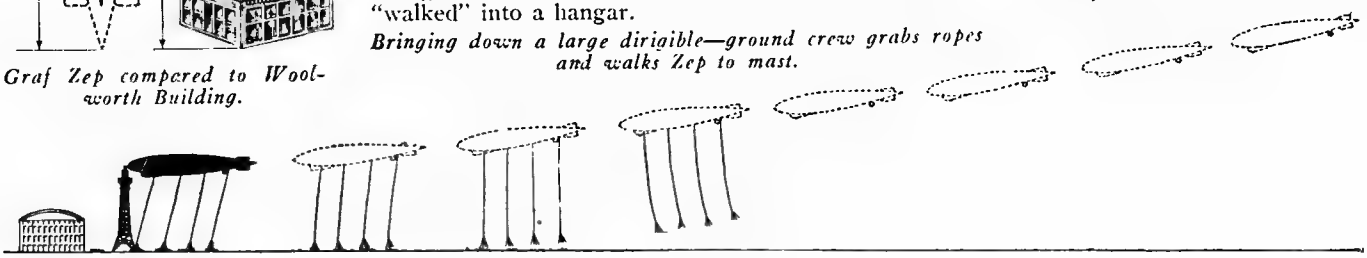
Round-the-world map at right shows path of *Graf Zeppelin* on her 25,000-mile air journey, on which she will make stops only at Friedrichshafen, Tokio, Los Angeles, and Lakehurst.

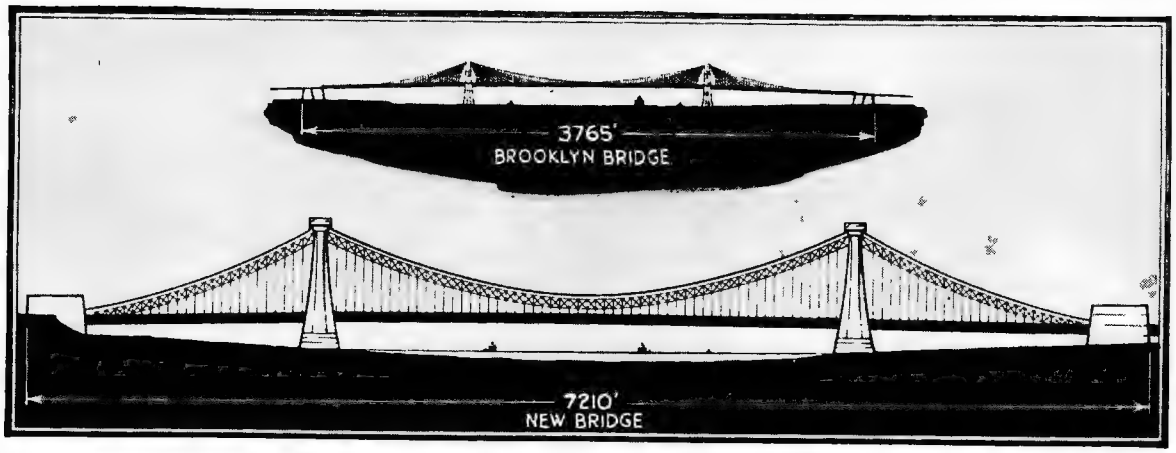


Graf's round-the-world route.

LANDING of a large dirigible such as the *Los Angeles* or the *Graf Zeppelin* is carried out as shown below. The airship steers downward under her own engine power and drops ropes down. When low enough, the ground crew grabs the ropes and pulls her down low enough to anchor on a mast, or still lower, when she is "walked" into a hangar.

Bringing down a large dirigible—ground crew grabs ropes and walks Zep to mast.



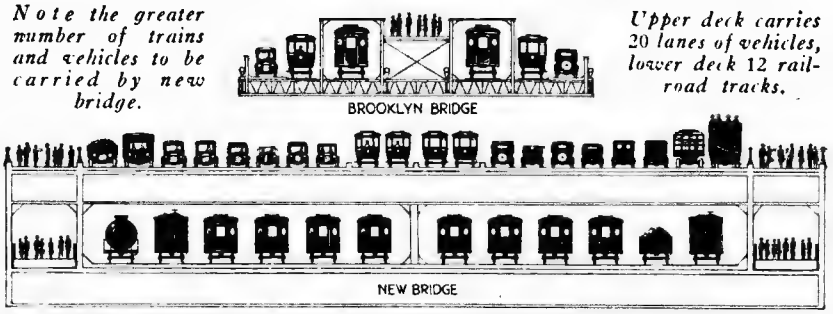


Comparison of the Brooklyn Bridge with the newly proposed Hudson River Bridge at 57th Street, New York City.

New HUDSON RIVER Bridge

To Carry Vehicles and Trains

Note the greater number of trains and vehicles to be carried by new bridge.



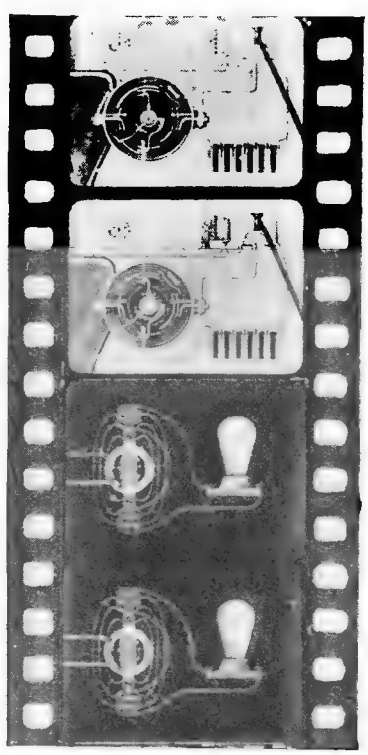
Upper deck carries 20 lanes of vehicles, lower deck 12 railroad tracks.

ANOTHER Hudson River Bridge recently proposed by the North River Bridge Company, in association with the Baltimore and Ohio Railroad, is estimated to cost $180,000,000 and would join New York City at 57th St., with the New Jersey shore across the Hudson. This gigantic project long contemplated is intended to relieve the severe traffic situation across the Hudson River, and also to afford the Baltimore and Ohio and other railroads direct access to the heart of the great metropolis. This huge bridge is designed to have two large decks, one above the other. The upper deck would carry twenty lanes of vehicles of all kinds, including trolleys, between two promenades for pedestrians on either side. The lower deck would provide space for twelve railway tracks and on either side of these tracks there would be space for two moving platforms for local passenger traffic. At about Tenth Ave. and 57th St. in Manhattan it is proposed to erect a new union railroad station at the bridge terminal. The bridge design involves the suspension principle and calls for a single river span of 3240 feet, with two side spans of 1590 feet each. The total length between abutments would be 7210 feet. The bridge design has been changed so as to give a clearance of 175 feet above the river for boat clearance, but the War Department engineers are asking a clearance of 200 feet, entailing considerably greater cost (*Continued on page 542*)

Engineering Taught by Movies

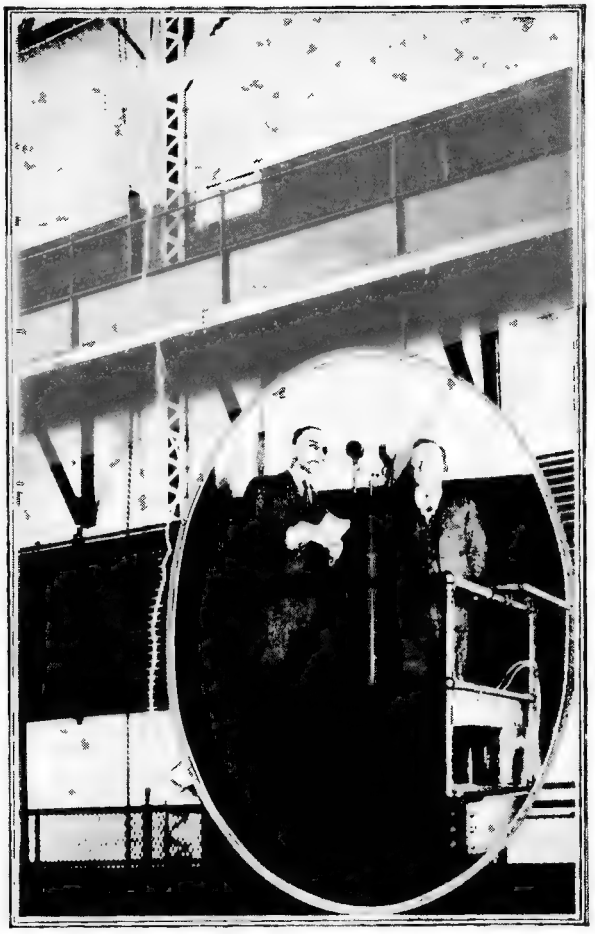
Home-study engineering student operating 16 mm. motion-picture projector and some of the "lesson" reels. He reads the lesson and then projects the images on the screen.

WHERE correspondence courses in engineering, not to mention resident courses, are concerned, there is probably no quicker method than that utilizing motion pictures, for quickly unfolding to the student the elementary action taking place as a current flows through a circuit for example. To those who have never seen an animated movie, such as those produced by Bray and used to a large extent in army and navy schools during the World War, it is not perhaps apparent at first why the motion picture should be so astonishingly useful in depicting the action of electrical and mechanical apparatus. Several scenes from one of the many "lesson" reels supplied to students by the National School of Visual Education are reproduced in the picture at the right. The two upper pictures show the circuits of an electric motor, while the two lower pictures show the action of a (*Continued on page 562*)



Artificial Lightning Broadcast by WGY

CRASHES of artificial thunder, produced by the new 5,000,000-volt lightning generator of the high-voltage laboratory of the General Electric Company, at Pittsfield, Massachusetts, were heard recently during a talk on lightning delivered by F. W. Peek, Jr., consulting engineer of the General Electric Company, from station WGY. The photograph shows one of the high-voltage sparks jumping a needle-gap in the laboratory. In the inset are Kolin Hager, WGY announcer (left), and F. W. Peek, Jr. A spark this long produces a crash very similar to real thunder.



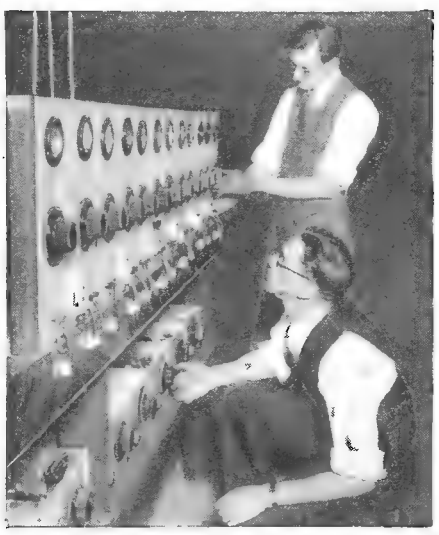
Broadcasting "artificial lightning" from station "WGY."

Altimeter Uses Radio Echo

A NEW type of altimeter, developed by Dr. E. F. W. Alexanderson, uses a reflected radio impulse to show altitude. The distance of an aeroplane from the ground is indicated by colored lights. Green, yellow and red lights give warnings at 250, 100 and 50-feet altitudes.

Steel Girder "Aerial" for Hotel

HOW to receive radio programs in steel-frame buildings is a problem that has held the attention of radio engineers for several years. Dr. F. L. R. Satterlee, retired X-ray experimenter, of New York, and Louis Kalosky, a Hungarian engineer, have succeeded in working out a system that uses the steel skeletons of such structures; retransmitting the program received over the steel so that it can be picked up by sets in any part of any given building. At the Hotel Lincoln, New York, where the system is in successful operation, six programs are received on six sets. All of them are transmitted via the steel framework of the hotel, giving to the guests the choice of six programs to tune in on. In the tests made thus far at the Lincoln there has been no crowding or heterodyning, and all of the retransmitted programs are free of static. The sets used at the hotel are all four-tube, all-electrics, which operate from the house current. Attempts to pick up the programs in other nearby steel buildings were unsuccessful.

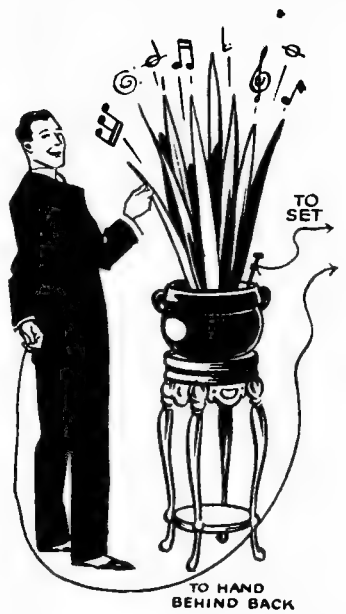


The master set installed at the Hotel Lincoln, which receives the radio programs and retransmits them via the steel-girder framework of the hotel. The guests of the hostelry have the choice of six programs.

Inventors of building frame antenna system, with one of the four-tube receiving sets.

A Mystic Radio

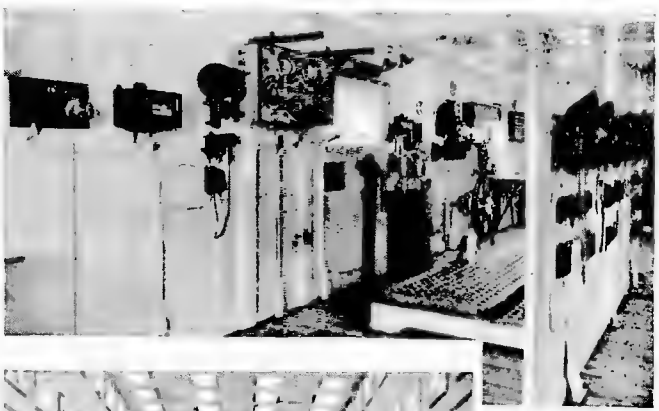
OPEN one connection to the loud speaker of a radio set and bring out two leads as shown. The speaker will operate when the leaf of the plant is grasped, if the set is working. On drawing the thumb and forefinger up the plant leaf, the sound gets softer and softer; and as the fingers are run to the tip of the leaf, the music ceases, to the astonishment of the spectators.—*R. B. Wailes.*

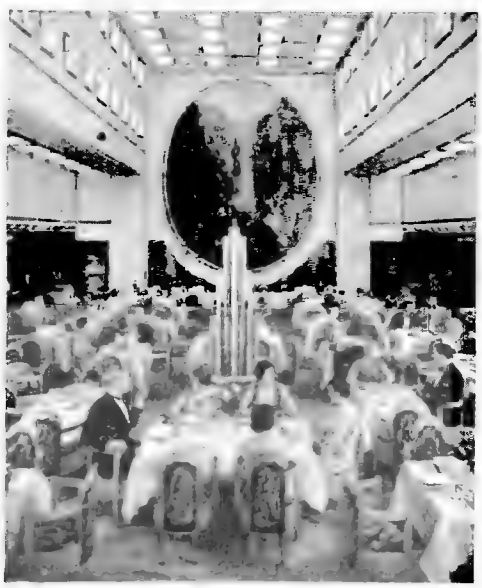


Who Will Build the FASTEST

By James

The "Ile de France," one of the fast, luxurious ships of today.





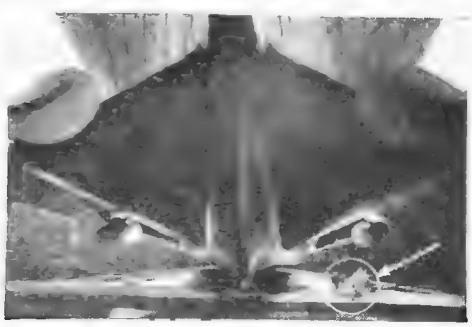
Above we see the "control bridge" of the "Ile de France." Note the loud speaking telephones, steering wheel, compass, and other instruments. An automatic ocean depth recorder is located here; also radio compass, etc. Left: main dining room with "artificial sunlight."

THE great ocean race is on again. Cherbourg breakwater soon will lie within four days of Ambrose light, off the port of New York. After fifteen years' delay, the world's big maritime nations at last have come to the starting line for the race suspended in 1914.

The last arrival in the Atlantic race turned into Ambrose Channel when the Bremen crossed the finish line, four days, seventeen hours, forty-two minutes from Cherbourg, a matter of 27.83 knots for the voyage. Or eight minutes short of nine hours faster than the Atlantic ever had been crossed before. Down came the "blue pennant" of the Cunarder Mauretania after twenty-two years as mistress of the seas. It was justice, in a way, because the Mauretania took her crown from a once famous German ship, the Kronprinzessin Cecile.

Any one looking at the Bremen steam up New York harbor could not doubt that her coming marked a period in ocean navigation—in world transportation by any medium. Even a Zeppelin cannot be expected to make a better average speed. The passing of supremacy from the steamship to the air has been definitely delayed. When no more than four short days—four revolutions of the globe—lie between the two hemispheres, it seems unlikely that we shall desert the leviathans of the deep for the motored monsters of the air.

And it well may come to pass that an American ship shall be the first to cross the Atlantic in four days flat. Theodore E. Ferris, designer of fast yachts, steamships and almost every other sort of craft that floats, believes a speed of thirty knots or better is now practicable. That would easily bring

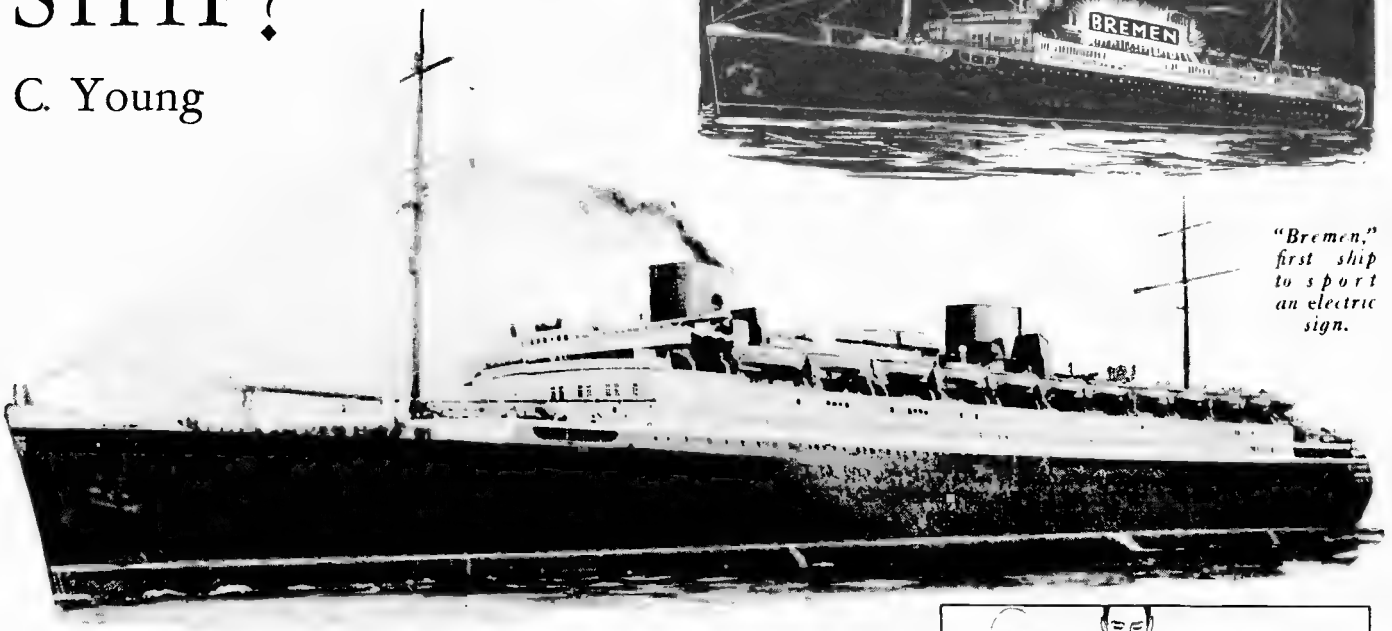


The four giant screws that propel the "Ile de France" across the Atlantic in fast time. Note the men in circle.

The fastest ships on the seven seas in another two years may be the new U. S. Lines proposed vessels, the appearance of which is shown in the above naval architect's drawing.

SHIP?

C. Young

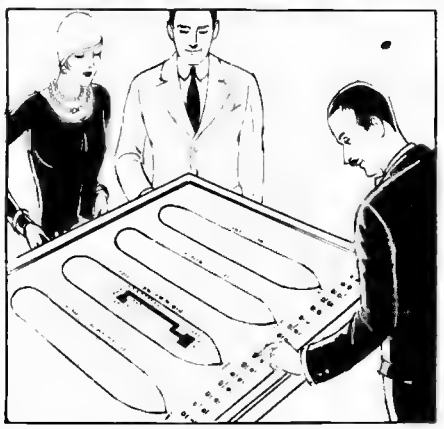


"Bremen," first ship to sport an electric sign.

Hoch "Bremen!" the new Queen of the Seas. This fast German ship broke all records in crossing the Atlantic, completing the time between Cherbourg and New York in 4 days, 17 hours, and 42 minutes. She develops 120,000 H. P., about twice that of the "Leviathan." The "Bremen" is 938 feet long and displaces 46,500 tons.

Cherbourg breakwater within four days of Ambrose light. Mr. Ferris is engaged in planning the two new ships of the United States Lines, which, he says, "will be the biggest and fastest ships on the Atlantic."

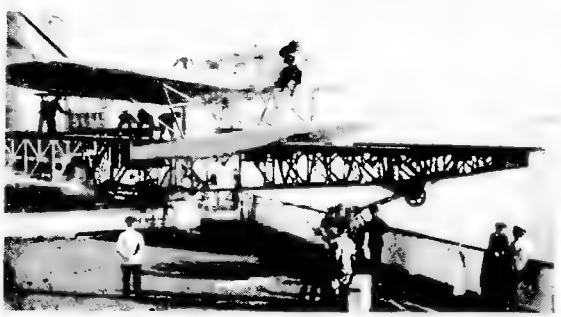
The Bremen was a revelation to shipping men who have watched the recent generations of ships pass through Ambrose Channel, for some decades the highway of the world. At the first glimpse she was seen to be a different kind of ship from any that had crossed the bar of New York. One man compared her to that noted piece of Greek sculpture, the galley of Samothrace, where the figure on the bow leans forward, literally drawing the ship behind. And the Bremen seemed to "lean" to her task.

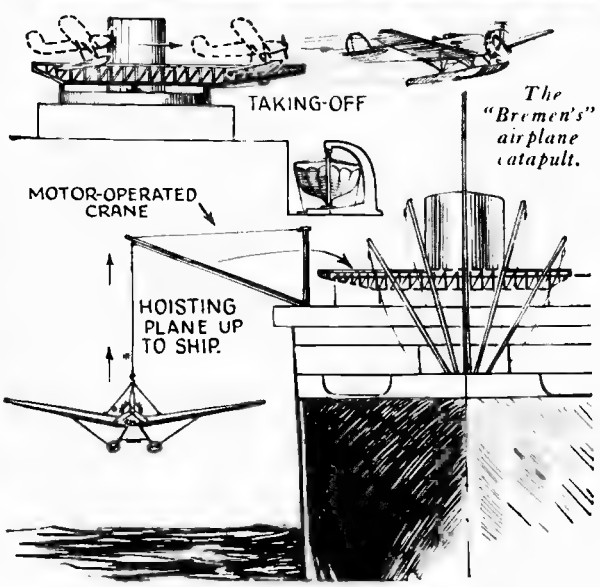


"Direction panels" on every deck of the "Bremen" enable the passengers to find out how to reach any officer or part of the ship, by simply pushing a labeled button. Immediately the route to the desired spot is illuminated.

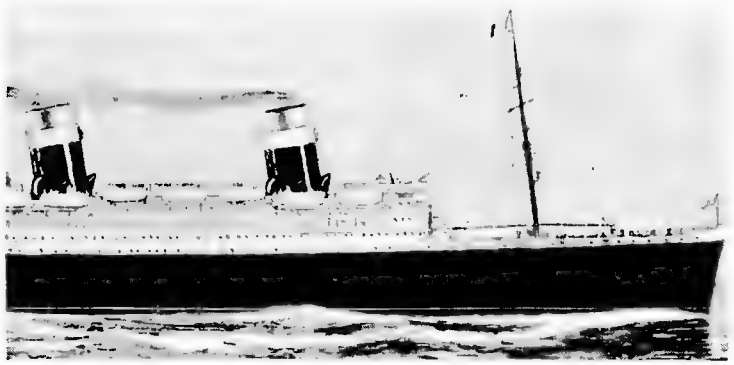
In fact, she is a ship of the "leanest" lines that has come into New York harbor for many a day. It is plain that the German designers profited from a study of their submarine experience and the science of aeronautics. The Bremen embraces something both of the U-boat and of the airplane. Looking at her under way, the impression is not unlike that felt in watching an airplane rise. She "leans" into the wind, her long hull flattened at the bow until the size of the ship is hardly realized by one who watches her.

This flattening process has touched every detail of the Bremen outside. Her forward superstructure, where the deck house rises from the hull, slopes gently backward, as though human hands had moulded it from clay. Then the two big stacks, fifty feet long and twenty feet wide, have been flattened as well. The hull widens to a ninety-eight-foot beam, disguised by the lean design. It tapers aft to a stern as lean—almost—as her nose. The 938 feet of the Bremen make her the second largest ship in the world. (*Continued on page* 544)





The "Bremen's" airplane catapult.

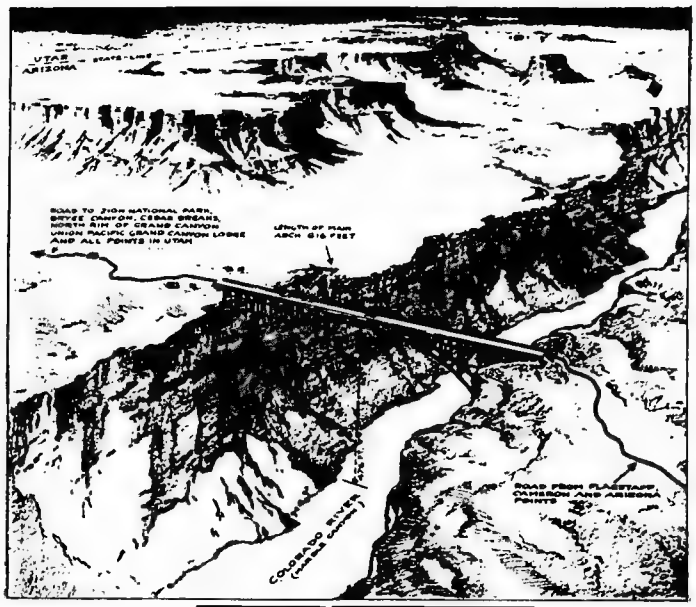


The new proposed U. S. Lines ships are expected to be about 1,000 feet long, exceeding the "Bremen," and their size of 55,000 tons is also greater than the "Bremen's."

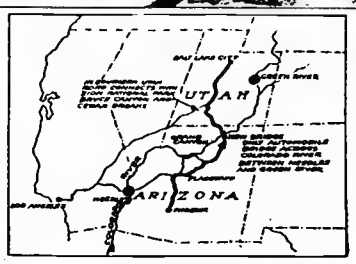
Scientific

New Bridge Over Colorado River

THE new bridge over the Marble Canyon in Arizona does away with the last of the old frontier. This bridge presents the only automobile bridge across the Colorado River, between Needles and Green River, and is located a few miles west of Lees Ferry and some 130 miles due north of Flagstaff, Arizona. At this point there was a ferry which was one of the few crossings of the Colorado River when the first settlers made transcontinental pilgrimages. The bridge itself has a span of 616 feet and dwarfs the Los Angeles City Hall, which is shown compared with it.



The illustration above gives one a good idea of the bridge and the topography of the surrounding land.

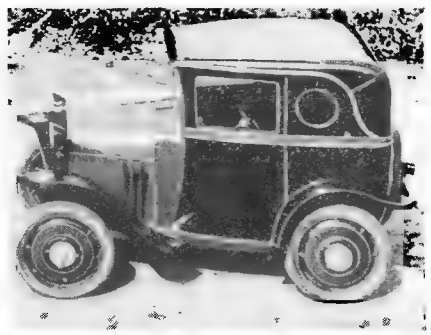


The map at the left shows location of the new Lees Ferry Bridge.

The road to the bridge leads from Flagstaff, Cameron and other points in Arizona and on the western side to Zion National Park and other points in Utah. A gorgeous view of the Marble Canyon of the Colorado River can be obtained from this structure. How many stop to consider that, with the constantly increasing strides in aviation, such bridges may in time become interesting landmarks only, even as did the ferry at this point. A plane needs no bridges, no highways, and its road is kept in constant repair by nature itself.

This Auto Will Sell for $200

THE tiny car here shown is the invention of James V. Martin of Garden City, L. I. There is no chassis, frame or springs. Each wheel is independently mounted and shock cord used in the place of springs. It weighs 600 lbs., does 50 miles on a gallon and is shipped in a weatherproof packing case with a hinged door. The case serves as a garage, if the owner does not want to build one.



The new poor man's car and how it compares with an average touring car; its riding qualities are said to be even better.

Moon Rocket Misses Moon

PROF. ROBERT H. GODDARD of Clark University, located at Worcester, Mass., is continuing his experiments with his "moon rocket." This rocket was intended originally to explore the higher atmospheres beyond those heights already reached by man. The structure shown at the right was built for directing the trial flight. A liquid explosive was used, but instead of the explosions expending their force gradually, as was intended, the entire rocket exploded when it was but a short distance beyond the guide. If you are interested in knowing how rockets reach the higher altitudes where there is no air on which the gas can react, see the Oracle Department in this issue.

This Machine Tests Fighters' Hearts

HARRY FORBES, the leading contender for the featherweight title, is shown here having his heart tested by the new portable electrocardiograph. This is the first time the machine has been introduced into the prize ring for this purpose.

Progress

Sixty-Mile-an-Hour Tank

A THREE-MAN, armored combat tank, capable of making 42.55 miles per hour over rough plowed fields and sand dunes, when equipped with caterpillars as the photo shows, and which can make 69.23 miles with caterpillars removed, amazed both army and civilian officials who witnessed the official army test. This high-speed tank is equipped with an anti-aircraft gun and presents but a small target to enemy aircraft.

New "sixty-mile-an-hour" tank.

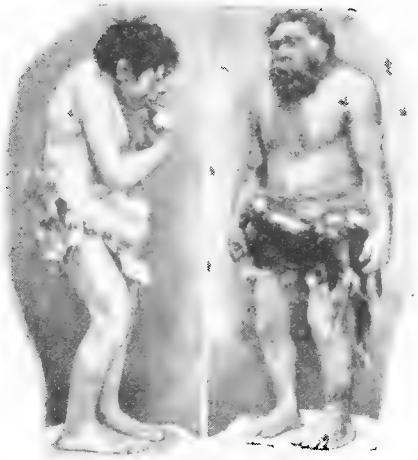
"Look Pleasant" When You Turn in the Fire-Alarm

TO discourage false alarms, a new fire-alarm system has been installed which not only registers the alarm, but takes a motion-picture of the individual who turns in the fire-alarm. The photographs here show the apparatus itself and also a reproduction of a portion of the motion-picture strip showing Mayor Walker of New York turning in an alarm at the fire-box.

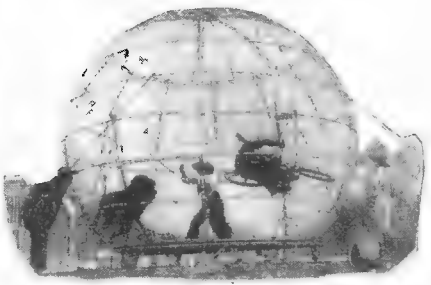
The fire-alarm system and the photos it takes.

A Life-Sized Cave Man

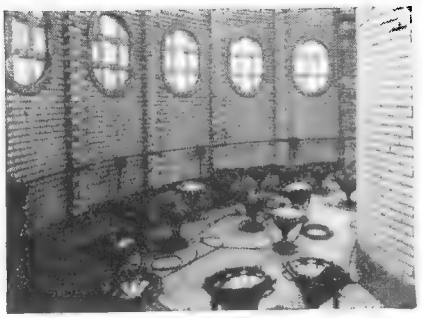
THE first authoritative life-sized reconstruction ever made of a cave man, his family and his cave has just been completed at the Field Museum of Natural History in Chicago. This is one of the earliest types of prehistoric man who lived in western Europe some 50,000 years ago and more. On the left is a photograph of a hungry boy about 12½ years of age of this Neanderthal type.



Another "Death" Cage



HERE is a stunt being demonstrated in Berlin which is a great sensation. It shows the thrilling chase between a lion and a motorcyclist in a large ball-like wire cage.

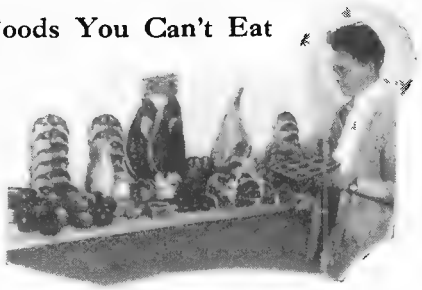


Floodlighting Dome of Building from the Inside

Showing how the flood lights are arranged in the building.

IN order to make the light "bend" around a curved surface so as to illuminate the top of the dome, it was decided to flood light the 36-foot dome of the new Williamsburgh Savings Bank in Brooklyn from the inside. The top is not glass, but is built up of horizontal louvers. The gilded surfaces of these louvers are then illuminated from the inside by varicolored lights.

Foods You Can't Eat

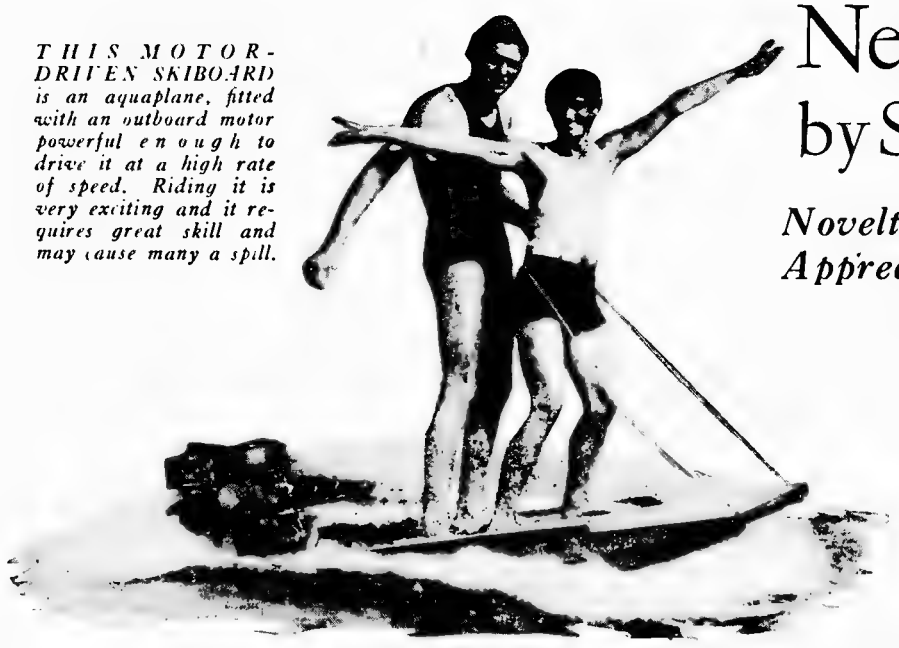


THESE lamb chops, steaks, rolls and bread are made for display purposes. The inside is sawdust and plaster of Paris; the outside wax, carefully colored and treated.

New THRILLS by Science in Sport

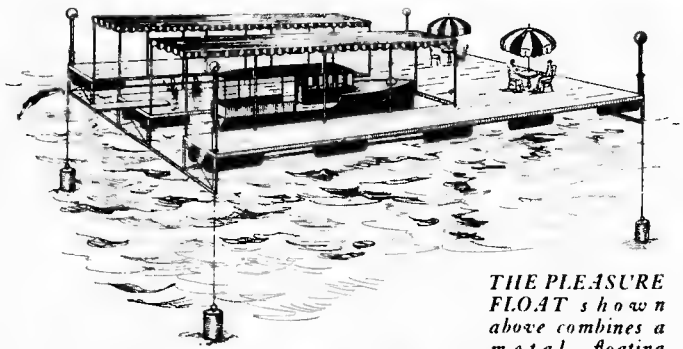
Novelties That Give Us a Keener Appreciation of the Playful Side of Life

By Henry Wells



THIS MOTOR-DRIVEN SKIBOARD is an aquaplane, fitted with an outboard motor powerful enough to drive it at a high rate of speed. Riding it is very exciting and it requires great skill and may cause many a spill.

INVENTORS are doing their part to help us enjoy ourselves in the realm of sports and to entertain us by various amusement apparatus which more often than not startle us by their sheer novelty of effect. Of course, one would naturally expect that most of these novelties would take on a watery aspect, if we may be permitted the pun. The outboard motor lends itself admirably to two new uses. We find the sponsors for these sports at opposite ends of the continent. The first was tried out in Los Angeles recently and is a special skiboard driven by such an outboard motor, which is steered by tipping the board slightly. A little too much tip and the riders get a ducking. We have as yet been unable to learn what happens to the engine when this takes place. At Winterhaven, Florida, an inventor used the outboard motor for operating an enclosed vessel with which he thrilled the crowds on the shore by making it perform a series of barrel rolls. A little more mild is the new-fangled surf-board, invented by James E. Wright, of Los Angeles, California. This device is illustrated on these pages. As can be seen, the surf-board has a sedan top, with suitable openings in the sides of the hull, through which the swimmer (who lies flat on his stomach) can put his hands and, by going through the regular swimming motion, can propel himself out into the ocean, where he turns around and rides back on the waves. While speaking of water sports, we must not forget the one invented by a police captain at Avalon, in the beautiful Catalina Islands. This consists of a 14-foot ball, which is inflated and which has been fitted with numerous short pieces of rope. Half of the ball is painted red, the other half is green. The object of the game is for the competing teams to get their color above the water. The thrills are many and the duckings are frequent, as one side suddenly decides to tug on the ropes or as quickly release them, plunging the opposing team below the surface.



THE PLEASURE FLOAT shown above combines a metal floating dock with slips for the entrance of motor-boats, a platform for accommodation of guests and diving boards.

"ELECTRIC SUNLIGHT"—Beach waves and sea breezes are the features of this indoor Lido, located underground in Paris.

It is not always possible for everybody to indulge in water sports throughout the year, and for this purpose our modern indoor swimming pools come to the relief of the aquatic enthusiast. But where in this country can we

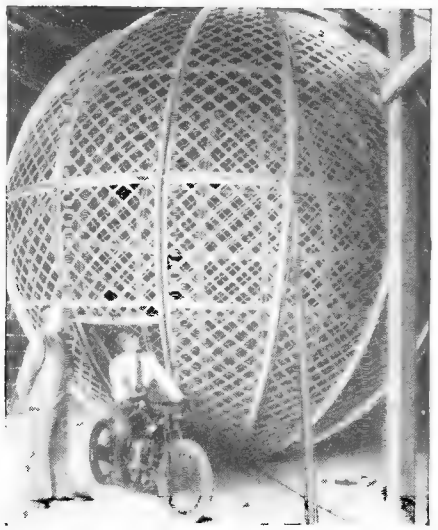
"BARREL-ROLL" à la motorboat at Winterhaven, Florida. The pilot now closes the top and—see right.

Shifting his weight inside, the "Baby Grapefruit" causes it to make a complete roll.

A close-up of the inventor and his craft.

ROLLING WATER SPHERE defies you to preserve your balance on its top, while others are attempting to upset you.

GLOBE OF CHANCE is this huge steel sphere, at the right, 57 feet in circumference, used by E. E. Phillmore, who drives his motorcycle around the interior in all kinds of loops.

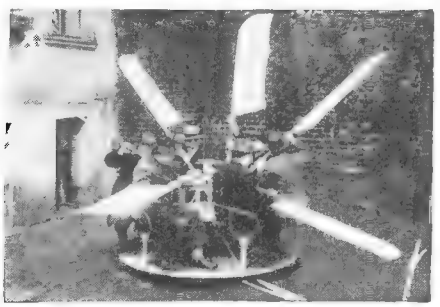


find a pool as unique as the subterranean Lido in Paris. Here is a swimming pool which reproduces in miniature most of the attractions of the famous Adriatic resort. It lies under the beautiful arcade which is one of the most attractive shopping centers in the Champs Élysées. Here we find a swimming pool with artificial sand, artificial sunlight which burns until 3 A. M.; a restaurant, a beauty parlor to relieve the ravages of the "sun," and the "winds," provided by fans suitably arranged and concealed. And here and there parasols of bright colors dot the underground beach.

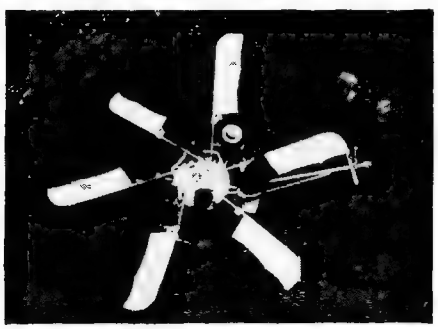
But we must not think that the inventors in this country alone are making special efforts to amuse the populace. In Berlin, Germany, an airplane novelty merry-go-round was recently originated and is now becoming very popular. The ground pilots cause the machine to rotate at a high rate of speed by raising and lowering the wings. There is no other form of drive. However, in order to get a certain co-ordination necessary for maximum speed, there is a crankshaft arrangement at the center connected with the fan blades. This forces a regularity of the fan movement and necessitates a certain degree of co-operation.

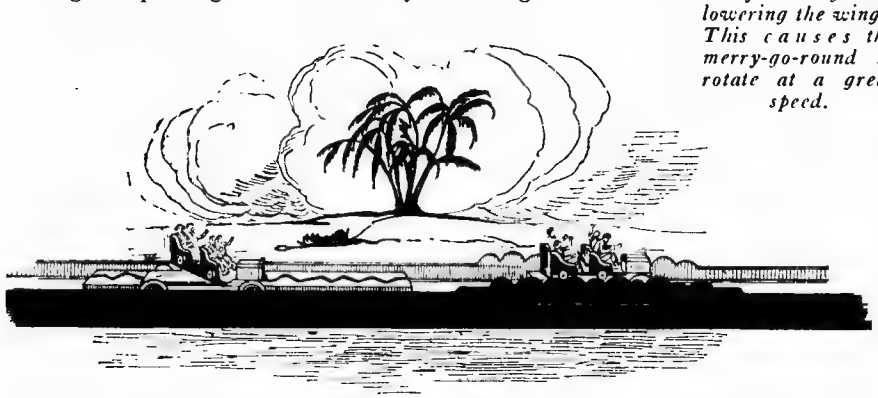
Those who are inclined to partake of greater thrills will find the invention of Gustave Melling, of Flushing, New York, of unique interest. We all know how roller coasters operate. Well, this is something slightly different from a roller coaster, in that the body of each car is so mounted on the chassis that it can swing from side to side and also is free to move up and down. Due to offsets in the road, the body of the car is given some severe bumps, even though the wheels themselves do not leave the track. Then, for added excitement, the body is whipped precariously back and forth, making the passengers feel that they are being thrown out

UNUSUAL SURF-BOARD is illustrated above. The user can propel himself out into the water by hand power. He projects his hands through openings in the sides of the board.



MOTORLESS MERRY-GO-ROUND, illustrated in the two photographs at the right, was recently built in Berlin. The occupants operate it by raising and lowering the wings. This causes the merry-go-round to rotate at a great speed.





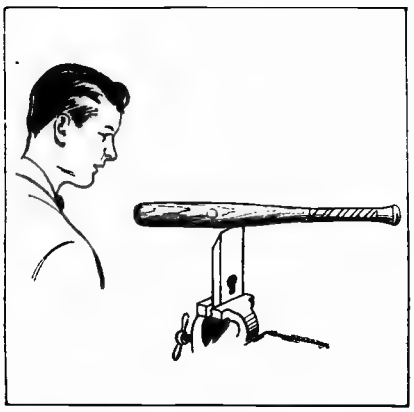
STARTLING ROLLER-COASTER here shown is an imitation automobile scenic railway in which the bodies of the cars are swerved from side to side, and the passengers are further given a startling up-and-down movement.

or skidding. Of course, ample safeguards have been provided.

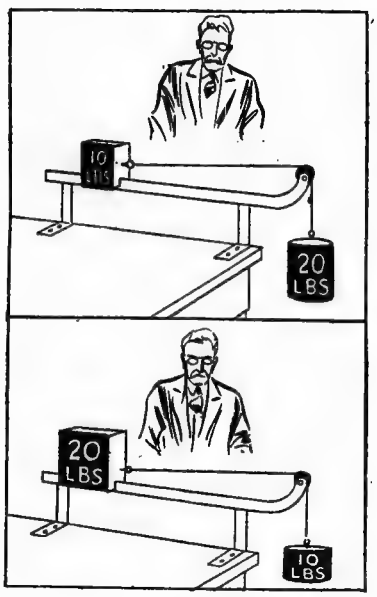
Something in the nature of a thrill that is exciting both to the rider and the spectators is a huge "globe of death," as the inventor, E. E. Fillmore, of Ocean Park, California, chooses to call his device. This is a latticed steel structure 57 feet in circumference. In this Mr. Fillmore, who is a motorcycle driver, loops the loop in all directions.

Can You Solve These Scientific Puzzles?

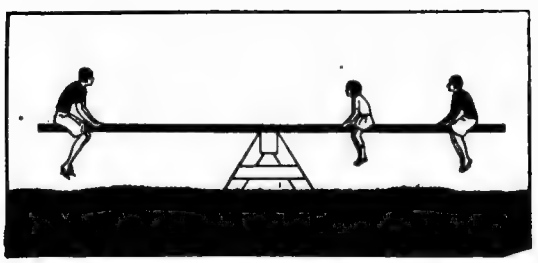
By Ernest K. Chapin



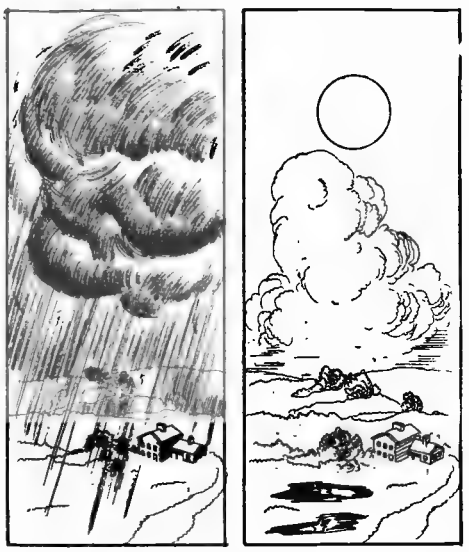
BALANCE a baseball bat on a knife edge. On which side of the knife edge is the most material? Are the two portions equal in weight?



WE shall assume that weights in the above pictures slide on the scale without friction. Which of the two systems of weights will slide more rapidly? In which of the systems will the tension of the cord connecting the weights be greater?



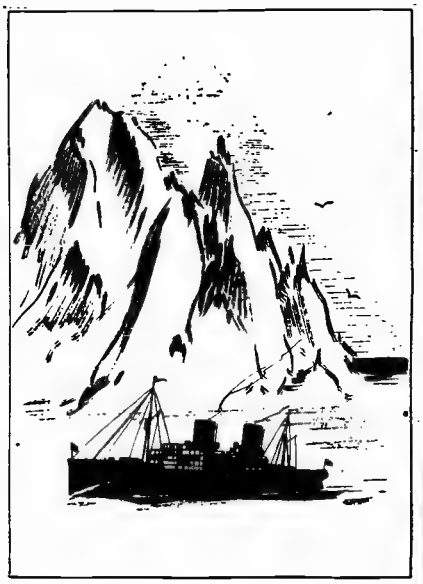
THREE little girls, Lena, Lora, and Lettie, are playing on a teeter-toter board. Lena and Lora are on one side and Lettie is on the other. They find that they can balance the board, when arranged as above, provided each one sits as many inches from the pivot as she is pounds in weight. Taking all the weights as whole numbers, if Lettie, who is alone on the one side of the board, weighs 102 pounds, what do the others weigh?



SUPPOSE that over a certain area there is enough moisture in the clouds and the surrounding atmosphere to cause one inch of rainfall. This would amount to over 70,000 tons of water to a square mile. After all this water has fallen, is the pressure of the air on the surface of the earth likely to be more or less than it was before?

LEADING manufacturers of watches recommend that their products be wound in the morning instead of in the evening. Why is it better for us to wind our watches in the morning instead of in the evening?

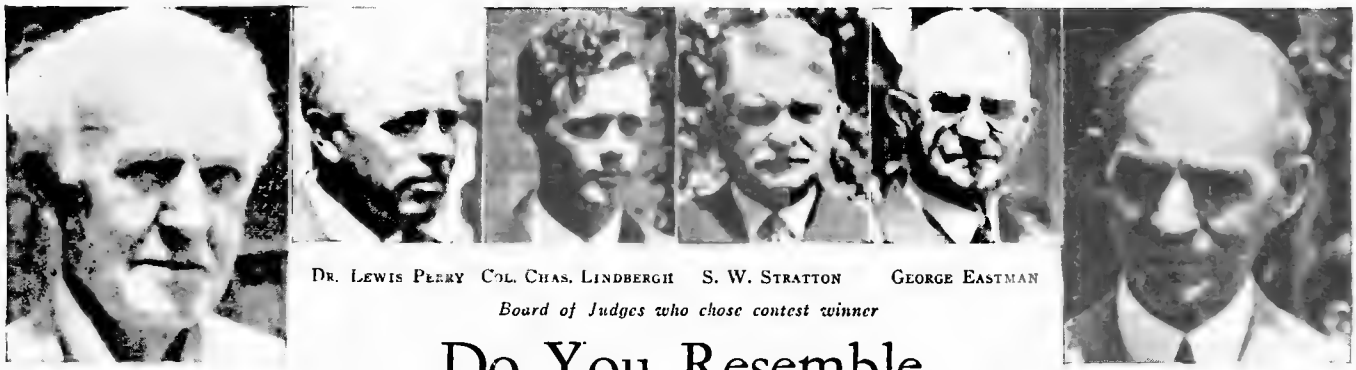
THE boy has his hand over half of the objective of the telescope. To what extent will the boy's view be restricted when looking through the telescope under the conditions?



ICEBERGS are subject to deposition of layers of frozen sea water. Sea water is salty. Is the interior of an iceberg salty?

WHY do the negative plates of a lead storage battery get very hot if removed from the acid and allowed to stand in the air?

(*Answers appear on page* 564)



THOMAS A. EDISON — DR. LEWIS PERRY — COL. CHAS. LINDBERGH — S. W. STRATTON — GEORGE EASTMAN — HENRY FORD

Board of Judges who chose contest winner

Do You Resemble The Typical American Genius?

ONE chance in forty-nine! That was the odds facing young Wilber Huston, 16-year-old American genius and student of science, hailing from the State of Washington. Some time ago Thomas A. Edison conceived an idea which would put the young science students of the country on their mettle. Mr. Edison said he would give a free scholarship in any technical school or college the winner chooses, if he surpasses all the other entrants in the test.

Elimination tests were carried on for many weeks by high-school teachers and professors, so that in each case the boy finally chosen to represent his state would be found well equipped, both as to education and character, in the national tests to be conducted by Mr. Edison at his famous laboratory in West Orange, N. J. Mr. Edison had the able assistance of several eminent men, including young America's idol, Col. Lindbergh, in passing on the merits of the written answers to the questions. The judges finally decided that Wilber Huston, son of Bishop Huston, of Olympia, Wash., had expressed the highest quality of thought and judgment in his solutions of the problems presented. Some of the questions involved mathematics, some chemistry, while others were intended to bring out the character of the entrant in the test. All in all, we think the idea was a very fine one. Mr. Edison presented each of the forty-nine boys, one from each state and the District of Columbia, with one of his combination electric radio and phonograph cabinets. Wilber Huston, first prize winner, has elected to take up a chemical engineering course at Massachusetts Institute of Technology this fall. All his tuition and living expenses while taking this course will be paid by Mr. Edison.

This composite picture of the typical American genius embodies the features of 49 boys

Compare your face with this "ideal" study of 49 young scientists

Besides this *Edison Scholarship* awarded to Wilber Huston, four other scholarships were finally decided upon, and these were awarded to the four boys who attained the next highest marks to Mr. Huston. Photographs of these four young gentlemen, each wearing a pleased look, appear at the bottom of this page.

We congratulate Wilber Huston, his four associates who also won scholarships, and Mr. Edison. This contest has done a great deal to show the deep interest being taken in science by the youth of our country. Another fact demonstrated by the tests was that the forty-nine entrants all ran close together, the percentages all being high. This speaks well for our high schools.

THESE FIVE BOYS WON SCHOLARSHIPS

Charles H. Brunissen, Connecticut, won scholarship — *Bernard Sturgis, Indiana, also won a scholarship* — *Wilber B. Huston, Wash., Honor Man* — *James Seth, New Mexico, also won a scholarship* — *As did Ivan A. Getting, representing Pennsylvania*

Would You Believe It?

Truth Is Often Stranger Than Fiction. Strange Things Are Here Presented With Photographic Proof.

Five-Dollar Yachts Always Full of Water

A $5.00 reed yacht.

INDIA balsas on Lake Titicaca are made of bundles of reeds or bulrushes tied together. The sails are also of reeds. They are often of large size and will carry several tons of cargo. They are exceedingly buoyant and safe and make excellent speed under sail. Lake Titicaca is over 12,000 feet above sea level. It is on this Lake that this type of boat can regularly be seen. The cost of one of these reed yachts of average size, sail and all, is less than $5.00. The yachts invariably contain water.—*Dr. A. Hyatt Verrill.*

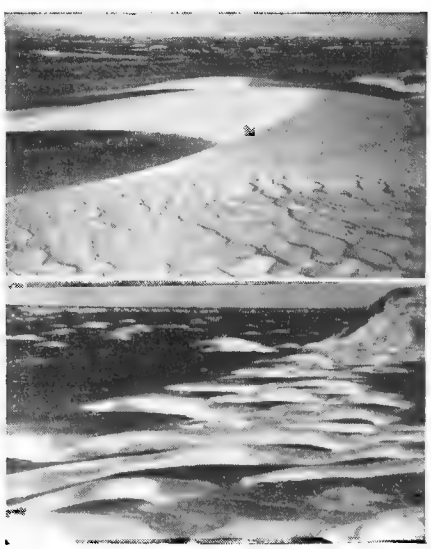
Demonstrating the method of extracting foreign matter from the lungs.

Dummy Figure Helps Teach Doctors

IN order to demonstrate his method of extracting foreign bodies from the bronchial tubes and the lungs, Doctor Franz Hasslinger, a Vienna doctor, employs a mannikin. The chest of the mannikin is cut away to show students exactly how the instrument is made to pass down to the lungs and how it is manipulated when once in this position. A motor drive on the mannikin reproduces the action of the heart and lungs just as if those organs were normally functioning.

Crawling or Traveling Deserts

ONE of the most remarkable and curious formations is the crawling desert of La Joya in Peru. Here the hard, dull-brown "puna" or high desert is covered as far as the eye can see with white crescent-shaped mounds, which range in size from several hundred feet to a few feet in length, and are as perfectly symmetrical as though carved by hand. Each of the strange white crescents has its convex side towards the north and points towards the south and every one is beautifully sculptured with waving ripple-like lines. Wind invariably blowing from the south piles up the sand on the convex side and it falls on the opposite side. The deserts move at a constant rate of 50 feet per year. This is the only place where such a formation is known.—*Dr. A. Hyatt Verrill.*



Above—The beautiful crescent formation of the traveling deserts in Peru.

A fisherman standing up in the mouth of a whale.

Man in a Whale's Mouth

IT is quite possible for a man to stand up in a whale's mouth. Lest there be some dispute about this statement the photograph here will vouch for the truth thereof. This is the open mouth of a 50-ton whale caught recently outside the Golden Gate in San Francisco Bay. The whale was towed into San Francisco, where it was to be converted into whale-oil soap and various other by-products of the whaling industry. The problem of getting the whale out of the water was solved by using a derrick barge. While the whale's mouth will easily hold a man, the food of the whale is very small.

Ever Hunt a Geoduck?

WHAT is a Geoduck? Very few people know this curious bivalve. For years there has been a ban on Geoduck hunting on the West Coast. The method usually adopted is to spear the neck of the Geoduck when it pokes this above the sand and then by digging very quickly one can get down to the shell. It is necessary to work very fast in order to capture them, because while they extend their necks to a tremendous length, when frightened they draw them down to a matter of but a few inches. The Geoduck is related to our soft-shell clam and its official title is *Glytimeris generoso.* It is found on the northwest coast of this country and is much desired for its food value.

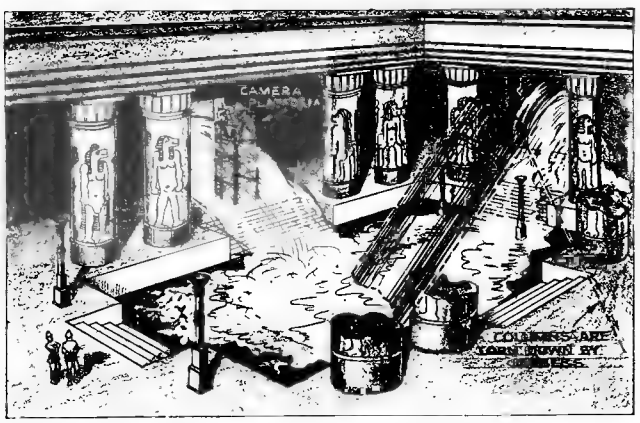
What a Geoduck looks like after it has been captured.

NOAH'S ARK Lives Again *for the* MOVIES

By Edwin Schallert

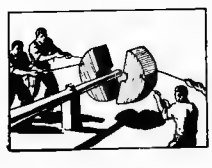
NOAH'S ARK was recently reconstructed by the motion-picture producer of the photoplay spectacle bearing that name, and the pictures herewith show some of the unusual engineering and construction work that had to be performed before this remarkable film play could be photographed. Among the many spectacular scenes in "Noah's Ark" there is shown the complete destruction of a massive pagan temple, and the city of Noah's enemies is shown, as well as the survival of the patriarch and his followers, including the death of the frantic, disbelieving multitudes who tried to seek refuge in the ark. (*Cont'd on page* 553)

Above we see a huge tank in which artificial rocks and trees were constructed and into which water was poured for the flood scenes. Lower view shows people fleeing from falling temple.



Spillways lined the side of the tank and were placed at other advantageous points. Hoses were used to agitate the water. So were numerous wind machines. There were also overhead pipes to drip the rain. In the background (right) was vista of mountains and sky on painted canvas back-drop. Reservoir was provided with sluices.

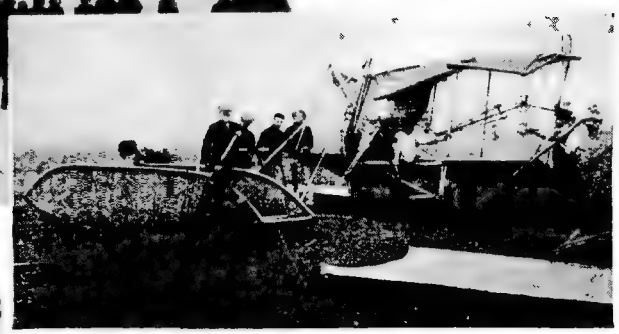
In this temple set preliminary scenes of destruction were first photographed. It was overhung with troughs and spillways. Hoses and rain pipes were also used to produce downpour. Temple pillars were pulled down by wires. The idol was pulled down in the same way.



How huge mill wheel was pulled apart at the proper moment by means of wires.

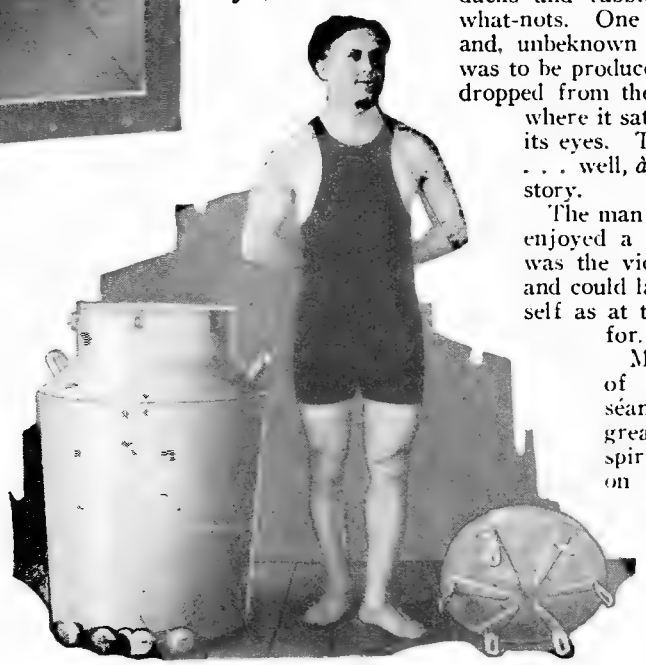
When FATE

Handcuff and Jail "Escapes" Always Enthralled Us; but Suppose the Locks Balked?



Houdini was an early experimenter with airplanes. Nearly 20 years ago he flew one in Australia with results that nearly proved disastrous. During the filming of the "Grim Game," Houdini jumped from one plane to the other, hundreds of feet in the air, in order to rescue the "beautiful damsel," but it almost cost Houdini his life. No sooner had he jumped from the plane, which flew about twenty feet above the other one, when the top plane crashed down on top of the other one. Thanks to the quick thinking of Houdini, no one was injured. "It was a GRIM GAME all right," said Houdini.

Above we see Houdini locked in the "water-torture" cell. This cell was filled with water and, if all did not work right, the magician might lose his life. The front of the cell had a glass panel.



Houdini and his famous "milk-can" trick. In performing this dangerous act, a large brass milk can was filled with water. Houdini then climbed into the milk can, filled with water to the brim, and the top was locked on by a committee from the audience. If he failed to release himself in a few minutes, well . . .

HOUDINI! King of Handcuffs . . . showman superior . . . magician supreme!

One of the greatest showmen of all time, whose career was cut altogether too short by the Master Magician, who wields the magic wand and causes all living things to come to an end.

Harry Houdini, accounts of whose sensational exploits throughout the world have appeared in newspapers, magazines and even in motion pictures, used to hold his friends spellbound for hours, telling of the many adventures, mishaps and experiences that had befallen him during his years of appearing before audiences the world over.

One day as we were sitting in Martinka's old magic shop Harry said to me, "Dunninger, one of the funniest experiences I ever had was back in my old museum days. There was an old fellow who was a clever magician of the old school. Professor Schlamm was his name. This master was one of the slow, patient, painstaking type of conjurers, who went to any length to make things seem of a real magical nature and whose sleights were of the finished sort. One night someone put tin plates in the bottom of the trap in his black art table. When the professor did his show, as each article vanished *via* the black art well (or trap in the table), an audible "click" was heard. The old fellow was beside himself, but put an unconcerned smile on his face until the show was over. Then he set out on a still hunt to find the one who played the trick on him. But his search was unsuccessful, and after that every time the professor was about to begin his performance one could see him carefully inspecting the black art wells to assure himself that no practical joker had tinkered with his outfit."

Houdini also told about a magician, in Germany, who featured the production of live stock, such as hens, ducks and rabbits, from gentlemen's coats, hats and what-nots. One night this magician was performing, and, unbeknown to himself, one of the rabbits which was to be produced later from a high hat, got loose and dropped from the wizard's special pocket to the stage, where it sat looking into the audience and blinking its eyes. The audience howled, but the professor . . . well, *à la* Kipling . . . that's quite a different story.

The man who laughed at locks and bolts always enjoyed a joke, whether he or the other fellow was the victim. He was a good fellow always, and could laugh just as heartily at a joke on himself as at the joke the other fellow had to stand for.

Many is the laugh he had at the expense of swindling spirit mediums. At one séance Houdini, under cover of darkness, greased the trumpet and tambourine of the spirit medium, and when the lights went on there sat the so-called communicator with the great beyond, with hands and face well greased and smeared, much to the surprise of the gullible believers and the hearty laughter of Houdini's friends who attended the sitting.

While making one of his sensa-

Fooled HOUDINI

By Dunninger

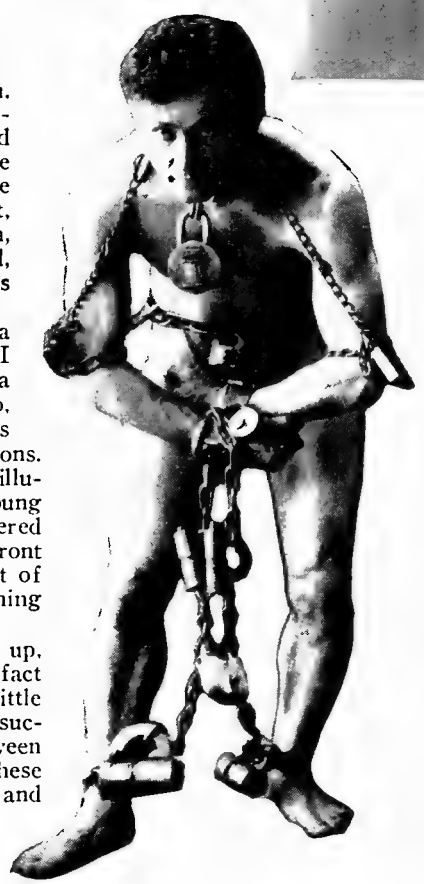
DUNNINGER, the world-famous magician and mentalist, who is chairman of the Psychic Investigation Committee of this magazine, is continuing the work of exposing fraudulent mediums as practised by the late Harry Houdini. Dunninger has had a very similar career to that of Houdini, and it is not only the judgment of the Editors, but that of the theatrical profession as well, that Dunninger is the logical successor to Houdini, with whom he enjoyed a very close friendship for many years, and we are sure that you will be delighted in reading the many unusual and exciting experiences that Houdini related to his friend Dunninger, and which are here revealed to the public for the first time.

Houdini played with fate thousands of times during his life, and it was always a battle of wits to see whether Houdini would get out of a cell like that above, when heavily manacled. Houdini often freed himself from these manacles when under water, and as a man can only stay under water for a few minutes without breathing, it will be readily apparent that Houdini took some mighty long chances.

tional escapes from an English prison. Houdini opened a cell door and confronted a prisoner who had been jailed for imbibing too freely the night before and who wasn't quite recovered from the spree. Houdini, attired in a running suit, naturally frightened the intoxicated man, who let out a series of yells and shouted, "Never will I drink again! Satan is after me!"

Which, by the way, reminds me of a laughable incident that took place while I was appearing at the Metropolitan Opera House in Philadelphia some years ago, when I was heading my full evening's show of magic, mind reading and illusions. I presented during my performance an illusion known as Cremation, in which a young lady was placed on a small stand, covered with four large pieces of board; sides, front and back, a shot was fired and the front of the assembled frame fell off and a grinning skeleton appeared.

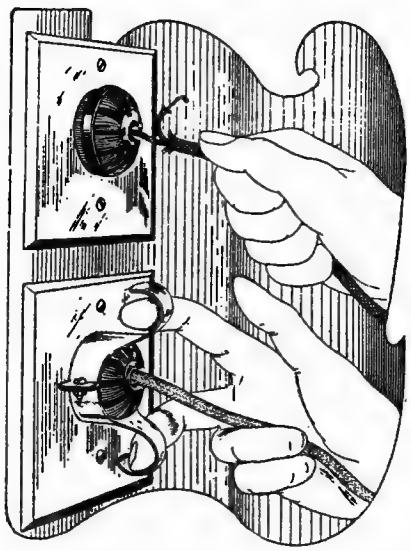
On this night, before the curtain went up, there was a still hunt back stage and in fact all over the house for three or four little pickaninnies who had somehow or other succeeded in getting into the theatre between the matinée and evening performance. These little imps had vanished completely, and neither the house, stage crew nor members of my own company could find them in their hiding place.



During the presentation of the Cremation illusion, the front board had been put into place by my assistants, and I fired my revolver, and when the skeleton came into view, we on the stage, as well as the spectators out in front, heard a number of shrill screams and a voice yelled out, "Lordy, be praised . . .!" And down the steps, from an upper box, trooped the four black imps, startled out of their wits. The house screamed, thinking it was part of the show, and my company laughed so heartily at the occurrence that it took a few moments for them to continue with the show.

Woven in with the heartaches and the trials of the magician are also the laughs and moments of merriment. A good laugh is a stimulant, but the magical entertainer would rather have the laugh on someone else than on himself, which after all is but natural. But when anything goes wrong during the modern magician's show, seldom is it noticed by the (*Continued on page* 556)

Time and Labor Savers

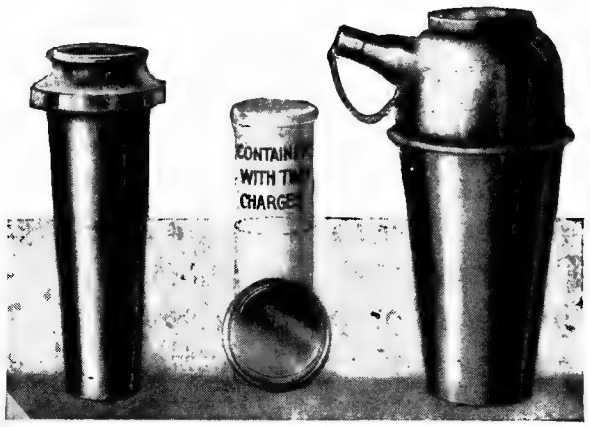


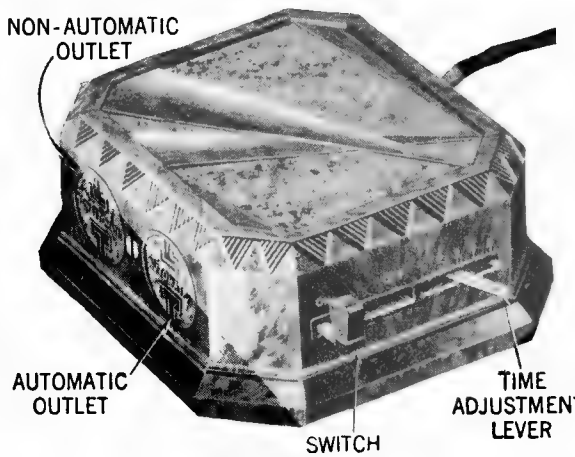
Plug Protector

THE above illustration shows a useful electric attachment which is readily slipped on to standard plug caps of any size and is fastened in place by tightening a screw. No rewiring is necessary and the two curved arms form a convenient grip for the fingers. The device also protects the plug cap from breaking and is finished in black to match the hard rubber or composition plug.

Iceless Cooler

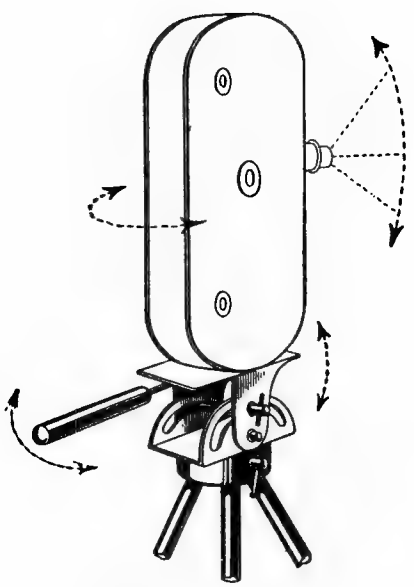
THE photograph at the right shows an iceless beverage cooler which is similar in construction to a vacuum bottle. A chemical is poured into the smaller cylinder at the left, a small quantity of water added, and the chemical container placed within the cooler, which contains the beverage. Ice cubes may be placed in the chemical container if desired.





Automatic Timer

A DEVICE which automatically turns off the current supplied to an electric toaster, percolator or similar appliance is shown at the left. The time adjustment lever is set to any desired position and the switch turned on. A clock-work mechanism flips the switch off at the desired time. An automatic and a non-automatic outlet are provided.



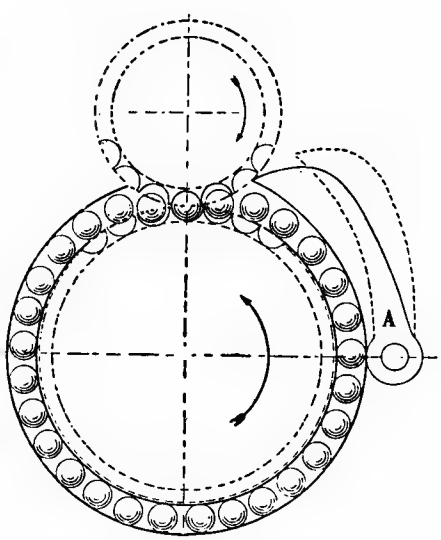
Tripod Head

AN all-motion tripod head for amateur moving picture owners, has been illustrated above. This attachment is fastened on to the regular tripod standard and permits the camera to be swung in all directions. The arrows indicate the freedom of movement which is accomplished by simply moving the handle attached to the tripod head.

Shadow Ball

THE illustration below shows a new type of punching bag which can be used as a substitute for shadow boxing. The ball is attached to an adjustable head band, by means of a heavy elastic. When the ball is punched, the same

action is obtained as in both shadow boxing and bag punching. Balls covered with leatherette or sheepskin, are also available.



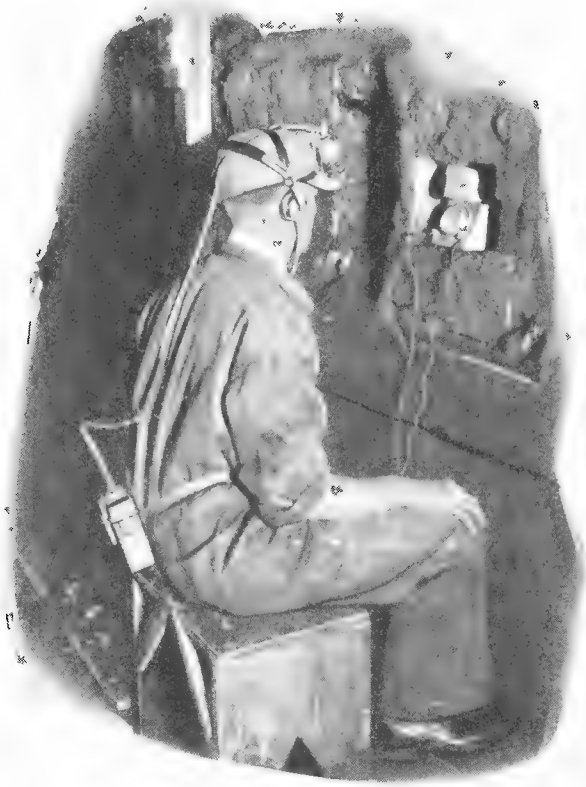
Ball-Bearing Gear

A GEAR DRIVE is shown in the diagram above in which the ordinary teeth of the wheels are replaced by steel balls. Turning the gear in the direction of the arrow, the balls fall from the right into the opening at the top, the lower wheel catches the balls and these gear into the upper wheel, until they go to the left, where the balls are free, and run through the housing to the bottom of the wheel.—*Technik fuer Alle.*

Names of manufacturers supplied upon request

Coal Miner's Job Safer Than Yours!

By Alvin F. Harlow



Listening, by means of sensitive instrument, to sounds in another part of mine.

Above—How track switch is extended into a hole in the wall and prevents danger to miner.

Telephone alcove in a modern mine. Telephone lines connect the various galleries with the surface.

Photos like this, showing how bar may touch trolley wire and cause death, are used to warn miners.

Mine foreman testing ventilation currents in a mine with a fan-like instrument.

Above photos courtesy U. S. Bureau of Mines

Photo courtesy U. S. Steel Corp.

A motion-picture auditorium in a coal mine, 215 feet underground.

(*Conclusion*)

"PREVENTABLE accidents," says the Bureau of Mines, "are generally attributed to carelessness, insufficient inspection, inexperience, unsafe practices, lack of safeguards, violations of instructions, indifference, defective equipment, use of intoxicants, insufficient lighting, poor judgment and other indirect causes." It is therefore not always and entirely the miner's fault that he is hurt. The campaign of education must extend to shot-firers, bosses, superintendents and even to some managers and employers—though there are few mine owners nowadays who do not clearly realize the value of safety and do what they can to promote it. As a matter of fact, some of the largest mining corporations have been leaders in devising safety methods, putting them into practice, educating their employees and inciting them by means of contests and rewards to use greater care.

Self-preservation is supposedly the first law of nature, but the surprising thing is that men cannot be induced to work for safety for the sake of their own arms and legs and lives as enthusiastically as when their plant is put in competition with others in a contest for the lowest number of fatalities or disabling accidents. Wherever contests of this kind are staged, accidents decrease in number much more rapidly. Of course it must be admitted that superintendents and bosses are also influenced by the spirit of the game to the extent of strengthening all safeguards and showing greater zeal and overseeing and exhorting the men.

Contests of this kind are now going on all over America. The United States Steel Corporation throughout its more than 250 operations (including mines, quarries, furnaces, mills, railroads and repair shops) maintains a "Star Bulletin." Each operation working for a month without a disabling accident is entitled to put a star on its bulletin at plant headquarters and also appears on the printed bulletin regularly issued by the Safety Bureau of the corporation in New York. The rapid increase in the number of stars shown in these bulletins is rather amazing when one considers that a mashed finger which will keep a man away from his work for one day will disqualify the plant for a star that month. Among their iron mines in Minnesota and Michigan, coal mines in Pennsylvania, Tennessee and Kentucky and both coal and ore operations in Alabama there are some which have been able to operate for a year without a disabling accident. Trophies are given to the subsidiary company and to the particular plant having the best record, and all sorts of bronze tablets, banners and banquets to the departments and gangs which make the best showing. And each year some plant erects a triumphal arch, indicating its supremacy in safety over all other operations of the corporation for the year.

A trade journal has prepared three replicas of a bronze statuette of artistic and symbolic design, which are given respectively to the plants making the best yearly safety record in coal mining, metal ore mining and quarrying and open pit work. At a zinc mine in Tennessee the safety contests between various gangs are symbolized by a miniature horse race in the window of the company's store which arouses interest equal to that of a world's baseball series. In the Missouri-Kansas-Oklahoma lead and zinc district the miners hold what they call kangaroo courts, the men themselves serving as judges and attorneys, and assess actual fines upon workmen guilty of causing accidents through negligence, and thereby (*Continued on page* 569)

Playing *with* Death

Dangerous Performances for a Living or Outdoor Sports

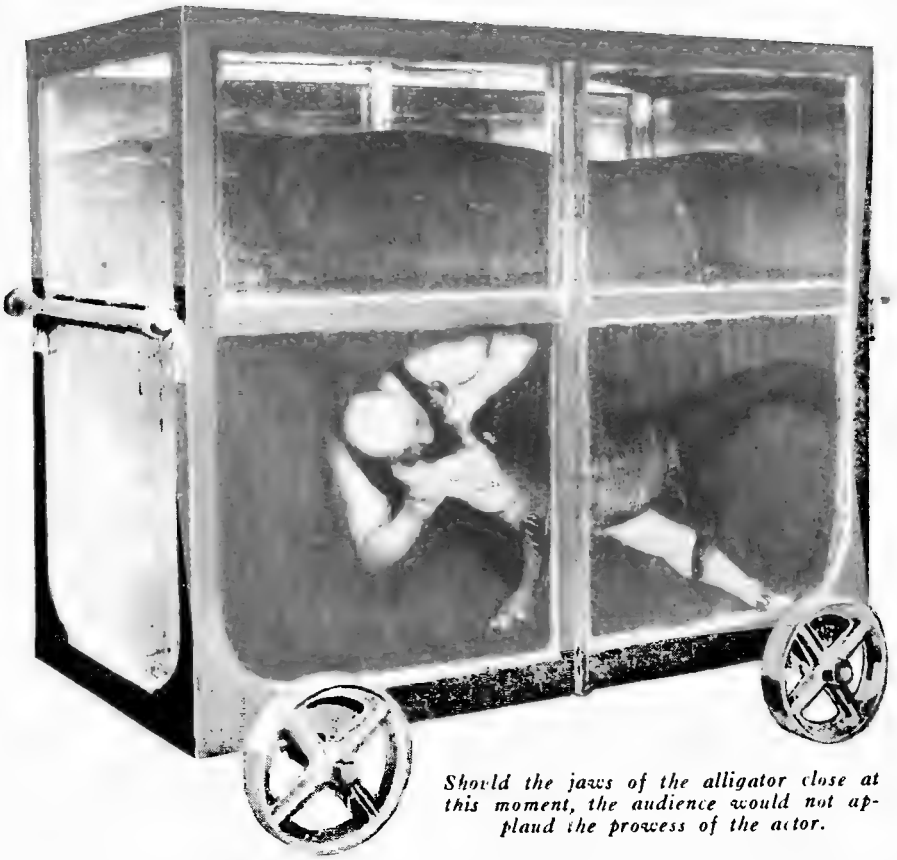
By N. A. Foazrim

A strange occupation. The man in the center supports two others by a sharp sword placed across his neck and shoulders.

JUST why is it that some people take chances with their lives? The answer is that some do it for economical purposes and some for advancing the art of sport. Not long ago, the audience of a famous circus was astounded when they saw a living human being slide into the mouth of a cannon and a moment thereafter saw him hurtling through space, landing in a net a considerable distance away. Here was a case where a man substituted himself for the shell as a load for a cannon. Of course, there was some trickery involved, but if anything went wrong with the apparatus, if the spring did not throw him into the net, if he did not know how to tumble properly, or how to adjust his body so that he could

A death-defying trick. With the point of a sword placed against the back of his neck, this artist holds a stick of dynamite in an improvised cannon in his mouth. If the recoil jars his head back when the dynamite explodes, we can write "finis" to this effect.

Looping the loop, while a man supports the apparatus, combines both skill and daring.



Should the jaws of the alligator close at this moment, the audience would not applaud the prowess of the actor.

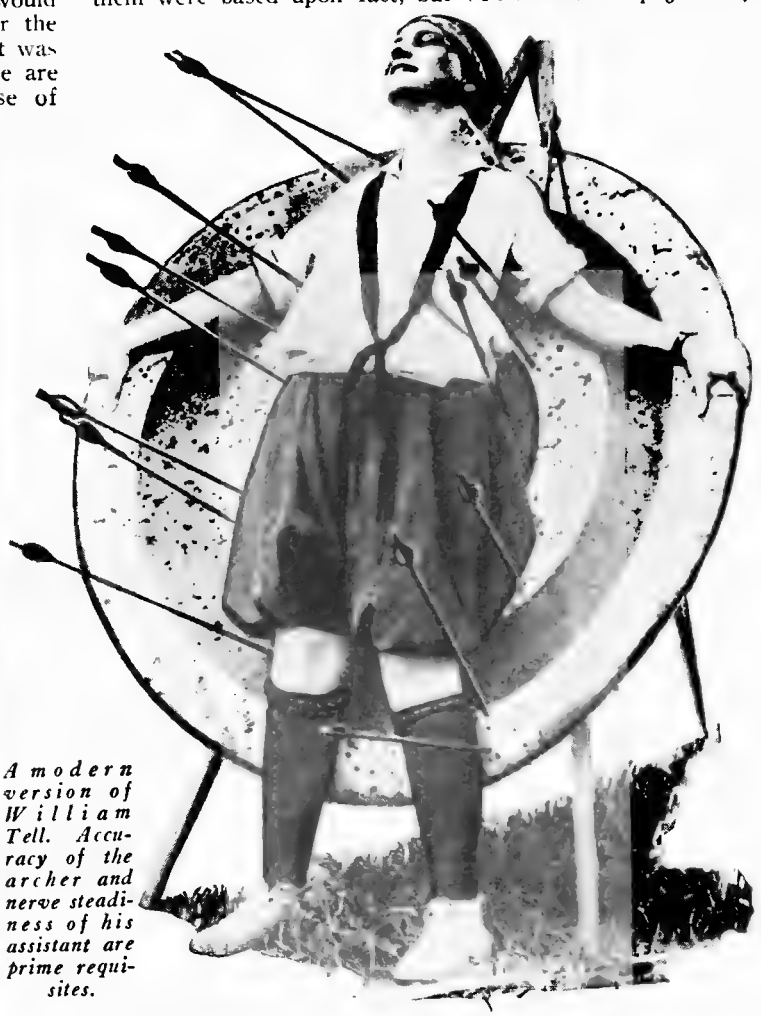
deviltry, because of the publicity attending such a demonstration, because of the desire of "showing off," or for some other physical or mental reason. The human being likes to acquire certain faculties which have supposedly passed the stage of normalcy. He likes to be noted for accomplishing one certain act or one certain deed better than his fellow men. Some of us want that act to be one of prowess, others find that it takes a path towards sciences or arts.

We frequently hear of prodigies. Ordinarily, these are individuals gifted in one particular field, usually they are not normal in others. They know perhaps more than a normal student of this one particular field, but the mentality runs in a channel widely divergent from the ordinary course of intelligence. All of the person's energy is directed along this one set path to the exclusion of any others.

Thrill performances can frequently be likened to those which a prodigy would give. Such performances are not new. Long before our present civilization, or in fact, any civilization, men have tried to do things that to ordinary people would seem impossible. History will record many thrilling performances which have never been duplicated by any human being. Perhaps these were exaggerated, as time handed down the legends. Frequently these thrill performances were mere figments of the imagination. On rare occasions the stories about them were based upon fact, but (*Continued on page* 575)

break the fall, there would have been many lapses between the individual demonstrations, the rest of the time would probably have been spent in the hospital waiting for the broken bones to knit. In this particular case the stunt was performed primarily for economical reasons, but there are others where the stunt is performed purely because of

For exercise, this woman takes a leap from a third-story window to the pavement below. In this way she gains her livelihood.



A modern version of William Tell. Accuracy of the archer and nerve steadiness of his assistant are prime requisites.

DUST!

2,100 tons of dust found on clear day in New York City's trillion cubic feet of air

The above illustration shows the size of a pyramid of one day's dust as compared with the Woolworth Building. On clear days 2,100 tons of dirt, dust and cinders are present in the atmosphere of New York City.

The photograph above shows Prof. H. H. Sheldon, of the Physics Department of New York University, setting in motion the clockwork of a machine which automatically determines the amount of dust in the air.

Prof. Sheldon claims that the dust-laden air is greatly responsible for respiratory diseases. He is shown above with the dust-recording apparatus.

THE prevalency of pulmonary and respiratory diseases in New York City, which are most noticeable during the windy months of the winter and spring, may be attributed to the tons of dust, dirt, cinders and other foreign particles which hover in the air of the great city. The one trillion cubic feet of air, which constitutes the atmosphere of New York City, contain at a minimum 2,100 tons of dirt, according to Prof. H. H. Sheldon, of the Physics Department of New York University, who has been assisting the Health Commissioner in a campaign to rid the city of unnecessary smoke and dust. The calculations are based on a study of New York City's air, made with the assistance of the Carrier Engineering Company.

At the Roxy Theatre 62,500 cubic feet of air a minute are purified, and during a week, figuring on a basis of seven 13-hour days, 341,250,000 cubic feet of air is cleansed. In the chambers where the air is purified there is an area of 180 square feet, which is covered to a depth of three-quarters of an inch with dust, dirt and similar matter. Since the purifying device is about 96 per cent. efficient, it is calculated that the air sent through in one week actually contained 11.72 cubic feet of dust and dirt.

2,100 *Tons of Dirt*

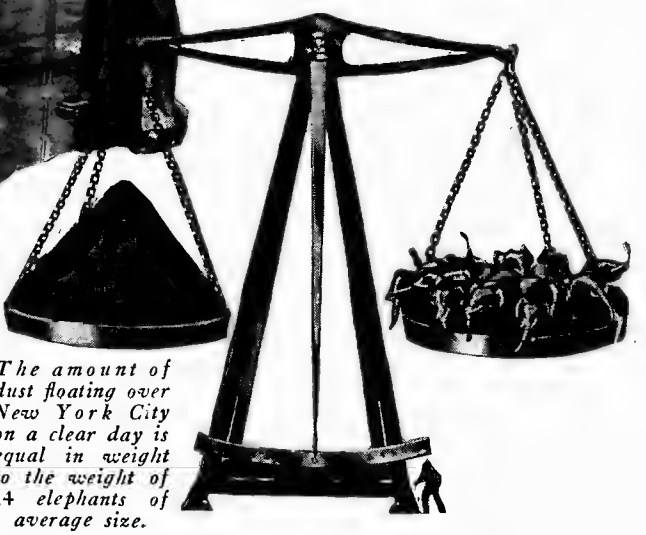
CONSIDERING the square mileage of New York City and taking a perpendicular distance of 200 feet as the immediate atmosphere, the total equals one trillion cubic feet. If the 341,250,000 cubic feet of air examined at the theatre contain 11.72 cubic feet of dust particles, one trillion cubic feet would contain about 3,000 times as much or about 35,160 cubic feet, which would weigh 2,100 tons.

As the tests were made in the vicinity of Times Square, which is relatively free from smoke, there is every reason to believe that the estimate is a conservative one for the entire city. In manufacturing sections the density of dust in the atmosphere is probably much greater.

The huge amount of dust present during one day in the atmosphere of New York City is equal in weight to the weight of 14 average-sized elephants, and if stacked in the shape of a pyramid, would reach a height of 400 feet when the base measured 200 feet. This is illustrated in comparison with the Woolworth Building.

What Is Dust?

WHEN atmospheric dust is collected and examined under a microscope, it will be seen to contain bits of vegetable fibre and all kinds of mineral fragments. When dust is allowed to settle upon cultures and kept in a warm room, a vigorous growth of bacteria usually is visible within a few days. This shows that living germs are present in the atmosphere, although they may be invisible even under the microscope. Some of these germs are injurious to man and animals and others, when brought to the ground by rain, may germinate on the wet soil and produce fungi.



The amount of dust floating over New York City on a clear day is equal in weight to the weight of 14 elephants of average size.

John Aitken of Scotland has shown that in the process of formation of a cloud or fog by cooling air the condensation of the moisture takes place first upon the particles of dust as nuclei. Every particle of dust collects moisture and upon this principle is based the construction of the dust counter. According to Aitken's findings in the cities of London and Paris, there are from 80,000 to 210,000 particles of dust per cubic centimeter. The air having the least dust is that of the western highlands of Scotland, which has from 7,600 down to 16 particles per cubic centimeter.

When dust is finely divided and the particles rather uniform in size a beautiful optical phenomena becomes evident, due to the diffraction and interference of light. This is noticed during the times of sundown and sunrise, when red, green and yellow colors are mostly visible. After volcanic eruptions, when much dust is present in the air, the sun appears blue during the daytime. (*Continued on page* 542)

Light Controls Machine

THE old *electric pup* which responded to a beam of light—started, stopped, barked, and followed in response to flashes of a light beam—has been brought up to date. The Westinghouse laboratories have conducted some recent experiments on a new and improved method of control by light. The results are more positive with this new apparatus and operation may be obtained with a weaker source of light than heretofore. This means that the apparatus can be controlled from a greater distance making the field of usefulness greater. The selective relay may be constructed to operate any number of different pieces of apparatus. The control apparatus is very compact and light in weight.

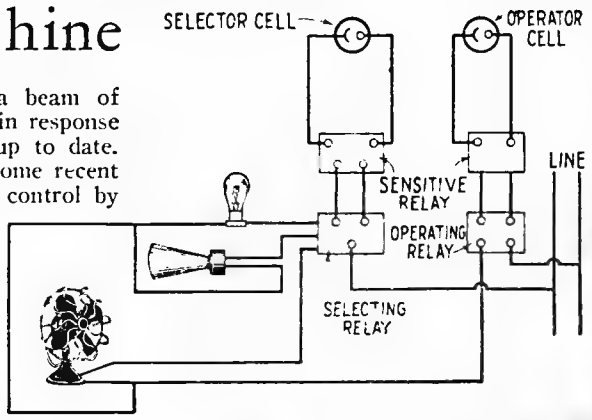
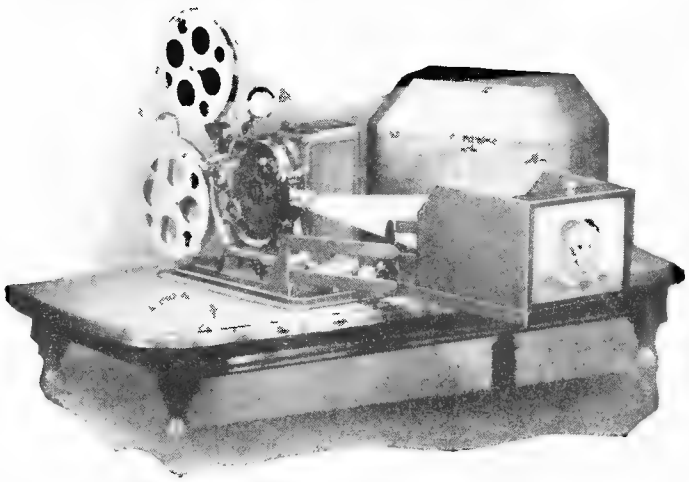
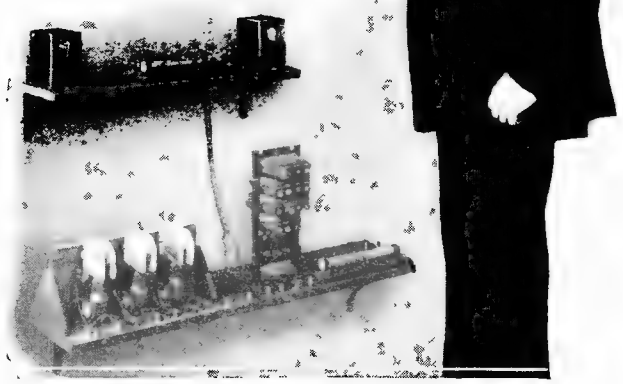


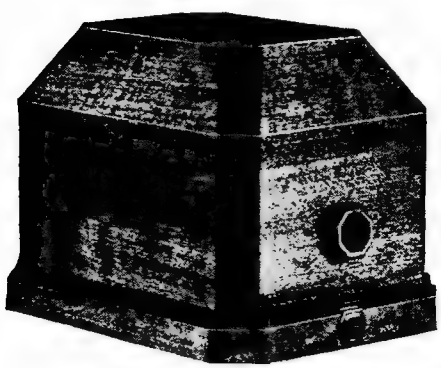
Diagram of the light control apparatus set up to operate a lamp, a horn, and a fan selectively.





The complete apparatus as set up in the Westinghouse laboratories. The light-sensitive cells are enclosed in boxes, so that they operate only from a direct beam of light.

Movie Projector for Your Library



Above—The library Kodascope, open and ready for projection.

At left—The library projector presents an attractive appearance, folded and enclosed in its neat-looking walnut case.

HERE is a motion picture projector that may be used right on the library table. It is not necessary to have a clumsy separate screen which must be stood in a corner; everything folds into a small box which takes little more room than a reading lamp. The screen supplied with the Library Kodascope is translucent; pictures are seen through the screen instead of being reflected as heretofore.

Due to the fact that light is direct, the pictures viewed on the translucent screen are surprisingly brilliant and beautiful.

Rotary Auto Engine

A ROTARY gasoline engine has long been the dream of scientists and inventors. A rotary engine without poppet valves, gears, cam shaft, push rods, or springs, which is air-cooled would be considered ideal. All these features are incorporated in the Augustine Rotary Engine. The compression, impulse, expansion, momentum and centrifugal force all travel in one direction; therefore, there can be no pounding in any of the bearings, all forces creating a constant torque and producing power. The lightness and efficiency of the engine make it a good power plant for airplanes as well as automobiles.

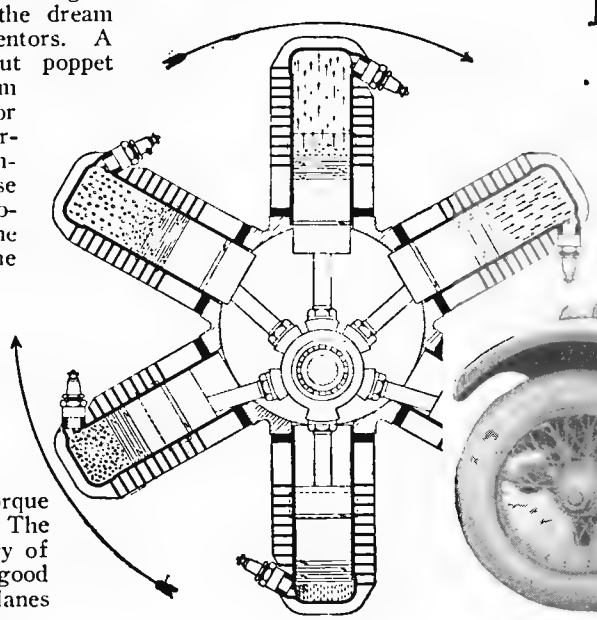
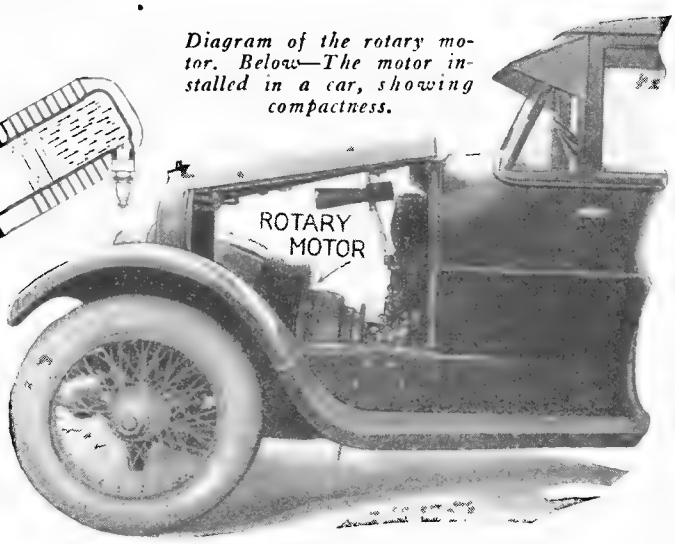


Diagram of the rotary motor. Below—The motor installed in a car, showing compactness.

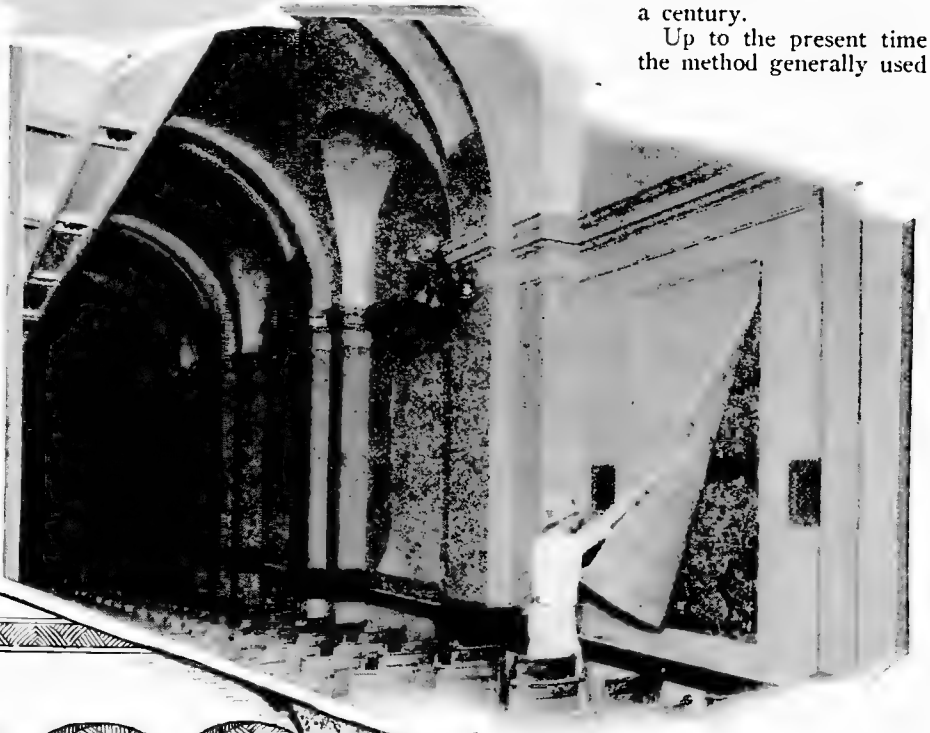


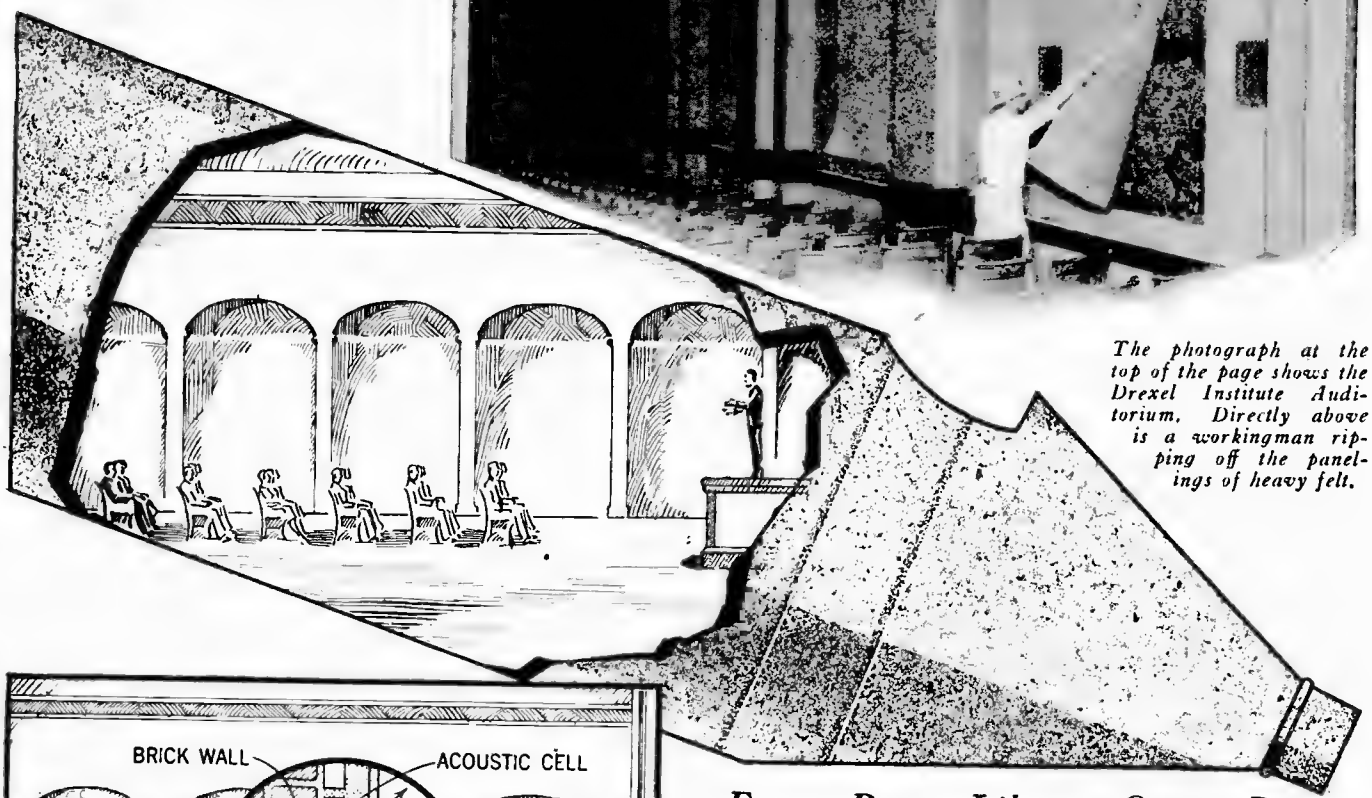
Making

By John De Quincey

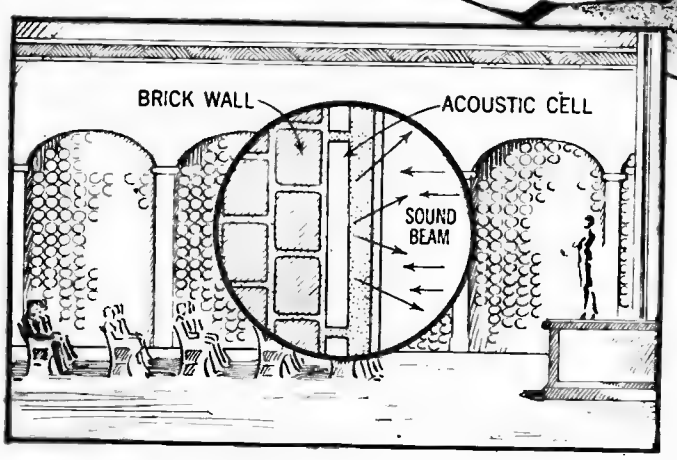
THE Trading Room of the New York Cotton Exchange —like all other rooms of that nature—has always been a bedlam of sounds during trading hours. Today one cotton broker's raucous voice can be clearly distinguished from another's nasal drawl. The change provides an audible demonstration that the baffling problem of hall acoustics—the despair alike of architects and speakers—has been solved. And appropriately enough the solver of the problem is Emile Berliner, whose invention of the telephone transmitter—known in radio as the "mike"—and the gramophone—known now as the Victor Talking Machine—has closely connected his name with the subject of sound transmission for over half a century.

Up to the present time the method generally used to remedy the reverberations in a hall was to pad the walls with felt or hang heavy draperies about the room. This helped to relieve the reverberations, but in their place came a certain deadness of sound—the resonance was gone.





The photograph at the top of the page shows the Drexel Institute Auditorium. Directly above is a workingman ripping off the panelings of heavy felt.



Every Room Like an Organ Pipe

An organ pipe emits a certain note when a rhythmic vibration is set up by the agitation of its air column. This principle also can be applied to auditoriums or rooms. The illustration at the left shows how the acoustic cells function. They transform a reverberating "booming" hall into a chamber where every sound is clearly understood. The sounds upon striking the acoustic diaphragms are "sprayed" back in a diffused form.

Sound Behave!

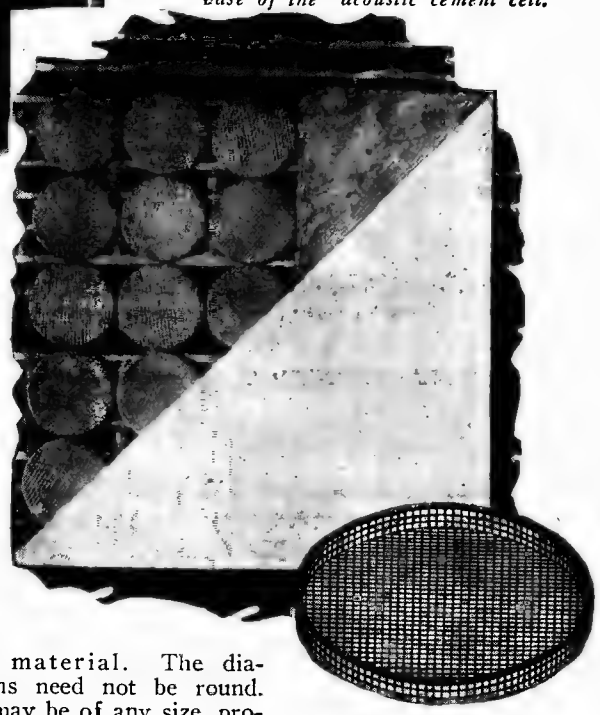
How Emile Berliner's Vibrating Wall Cells Prevent "Booming" in Auditoriums

Berliner's invention not only eliminates the reverberation but increases, instead of killing, the resonance. It is a most simple device. A section, or unit, of a wall treated with this invention gives the appearance of a smooth nine-inch square tile of about a half inch thickness. The under side reveals a circular depression eight inches in diameter and a quarter of an inch deep, lined with a galvanized wire netting. The substance of the "tile," or "acoustic cement cell," as Berliner describes it, consists of a special kind of porous cement mixture.

The above photograph shows Emile Berliner, the inventor, watching the manufacture of the wire cells forming the groundwork.

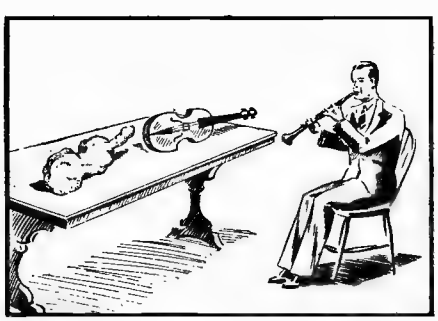
At left: The recently "treated" trading room of the New York Cotton Exchange.

Below is a close-up view of the "treated" wall and of a wire cell which forms the base of the "acoustic cement cell."



These acoustic cement cells massed together form what appears on the outside as a flat cement wall. The finished wall thus consists of a series of concealed diaphragms, endowing an otherwise rigid wall with the same vibratory quality possessed by a wooden structure. And it is the acquirement of this vibratory quality that transforms a reverberating "boomy" hall into a chamber where every sound spoken is clearly understood. The sounds on striking these diaphragms are not reflected back as beams or shafts of sound, as would otherwise be the case, but are "sprayed" back in a diffused form and with amplification of volume. The amplification is due to the fact that every sound emitted from the stage is "sprayed" back to each auditor from three walls.

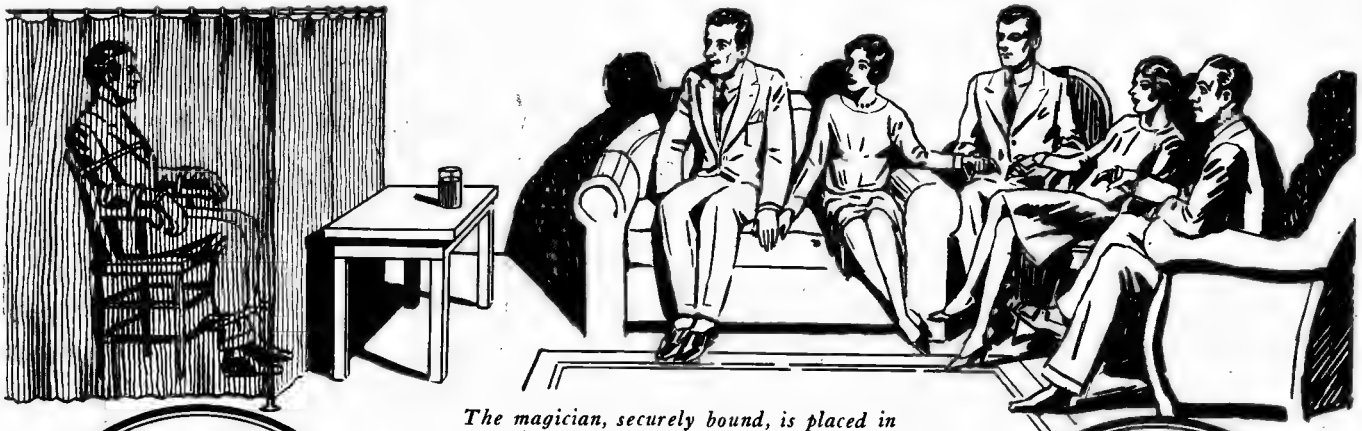
Berliner's patents in connection with this subject are very sweeping, covering any method of treating a wall with a number of diaphragms or similar partitions, made of cementitious material. The diaphragms need not be round. They may be of any size, provided the thickness is kept in proportion to the diameter.



A clarinetist plays an ascending scale in front of a violin encased in cement. When the note is reached which corresponds with the violin's body of air, it is sounded forth with several times the volume of other notes. No results occur with an ordinary violin.

The invention seems like simplicity itself—as valuable inventions often seem to be. But the work that preceded it, and the formulation of the principles on which it is built, has consumed a number of years. In fact, it may be doubted whether Berliner would ever have conceived or perfected this invention had it not been for his extended technical knowledge of acoustics, which covers more than a half century. An understanding of this background is necessary to an appreciation of what Berliner has really accomplished.

His invention grew out of two basic propositions. The first is this, to quote his own (*Continued on page* 551)

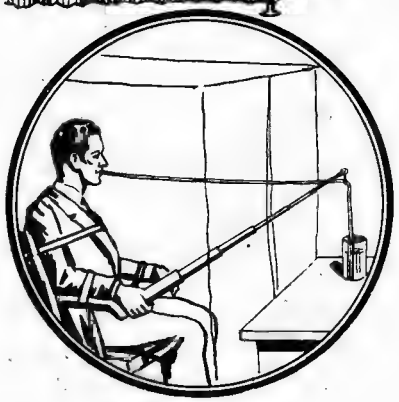


The magician, securely bound, is placed in a cabinet and a glass of water is put on the table in front of him. He drinks the water out of the glass from this position.

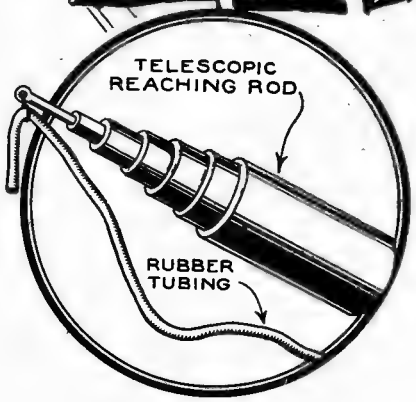
MAGIC

By Thurninger

NO. 74 OF A SERIES



The magician makes use of a rubber tube and a telescopic reaching rod, as shown.



How the rubber tube is attached to the reaching rod is here indicated.

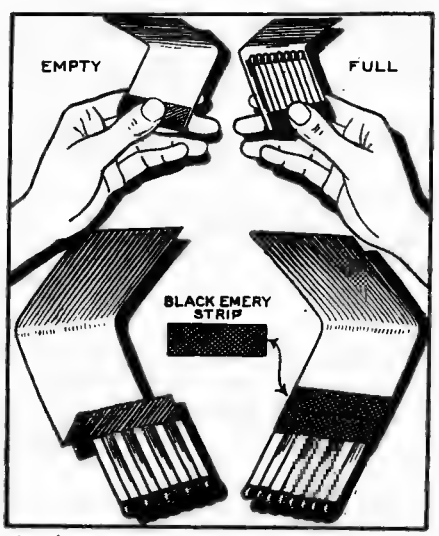
The Wizard's Mint

THE magician requests the loan of a $20 bill, but his audience is not inclined to give him this. In a nonchalant manner he places a cigarette between his lips and, showing his hands unmistakably empty, he picks up a cigar lighter (or cigarette lighter, whichever term you prefer) and proceeds to light the cigarette. He puts the lighter on a nearby table; then, cupping his hands together, he produces a $20 note, apparently from the cigarette. Secret: The construction of the lighter is responsible for the production. The bottom of the lighter has an extra fitting in the form of a receptacle which will hold a bill or a tightly rolled handkerchief, and the production of either the kerchief or the bill is from this portion of the lighter. The device can also be used as a vanish.

A pocket cigar lighter can be so changed that it can be converted into a bill.

The Spirit That Drinks

THE demonstrator, even though securely bound, shows that he is able to drink a glass of water, mounted on the table in front of him and out of his reach, just as soon as the lights are extinguished. The bindings are never tampered with. Secret: Concealed where the magician can easily get at it, he has a telescopic reaching rod, to which a long piece of rubber hose is attached. The rod is pushed through the curtains, the hose dipped in the water and the other end enters the magician's mouth.



Showing a paper of matches empty at first, a simple pass fills the paper with good matches.

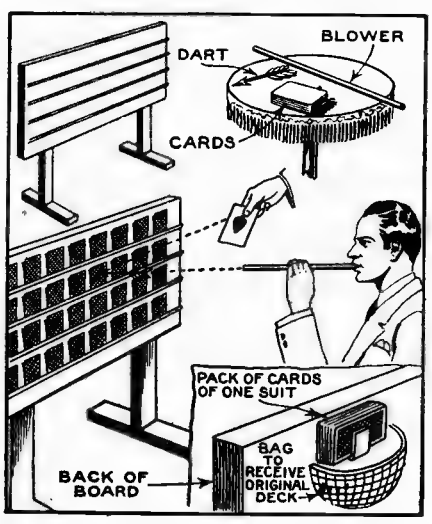
Mysterious Matches

FIRST, showing the paper of matches empty, the magician closes the holder, makes a few passes over it, then opens it and demonstrates the paper is full. Secret: Paste the black striking strip across the lower edge of a full case; hold case so as to conceal matches.

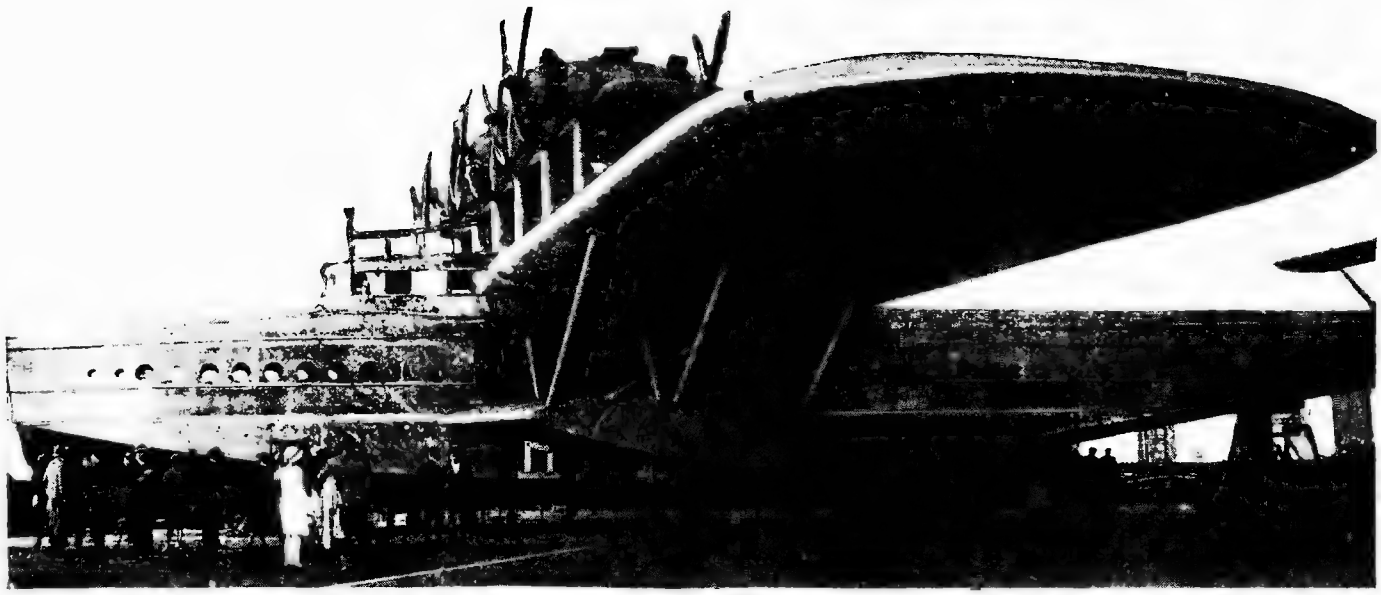
Supreme Court Mystery

A CARD is chosen by a spectator, then returned to the deck. The deck is completely shuffled, after which the individual cards are placed side by side on the rack. A spectator is then requested to blow a dart at any of the cards on the board. He is given free choice. Upon removing the dart and showing the face of the card to the audience, it is found to be the one selected. Secret: On back of the board is a suitable bag and holder containing a deck of cards, all of one suit. The original card is forced. Under the act of pushing the board in place, the magician drops the shuffled pack into the bag, exchanging it for the prepared deck.

Naturally, any card the dart strikes will be the ace of spades.



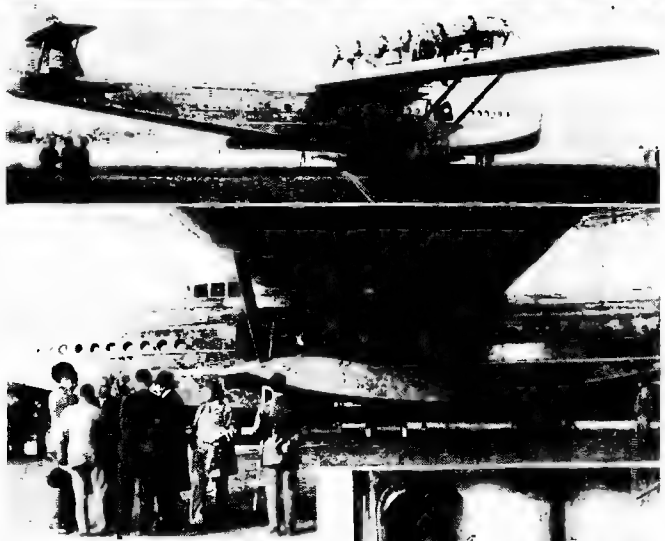
A shuffled deck is arranged on a rack. Any spectator blows a dart towards the cards and selects the ace of spades.



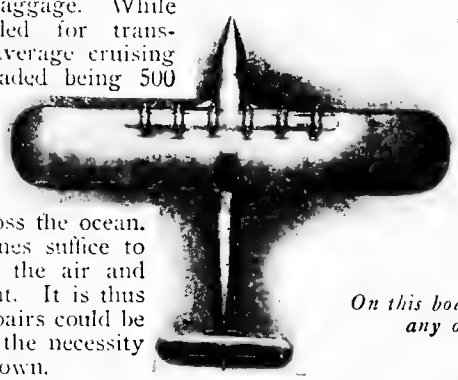
The largest flying boat in the world in its hangar.

Germany's 120-Passenger, Twelve-Engined, Trans-Oceanic Air Liner

THE largest flying boat in the world has recently been finished at the works of the German Dornier Aircraft Company on Lake Constance. This immense flying boat required the services of 500 men who labored for more than 2½ years to complete it. The wings are covered with a new super-strong fabric and the 12 Siemens-Jupiter motors develop a total of 6,300 horse-power, which is more than twice the available horse-power on the "Graf Zeppelin." The vessel will carry a crew of ten men and 120 passengers, together with their baggage. While not primarily intended for trans-oceanic flights (the average cruising radius when fully loaded being 500 miles), by cutting down the number of passengers and increasing the fuel supply, the vessel could easily cross the ocean. Eight of the 12 engines suffice to carry the vessel into the air and maintain it in its flight. It is thus obvious that motor repairs could be accomplished without the necessity of bringing the ship down.

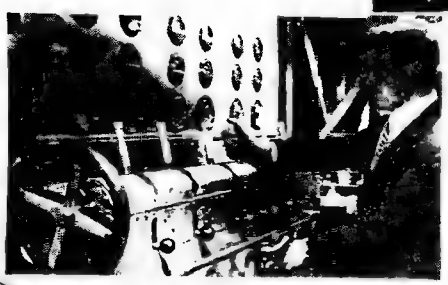


This vessel will travel at a speed of 155 miles an hour with only eight engines going. The ship is 149 ft. long and has a wing span of 157 ft.

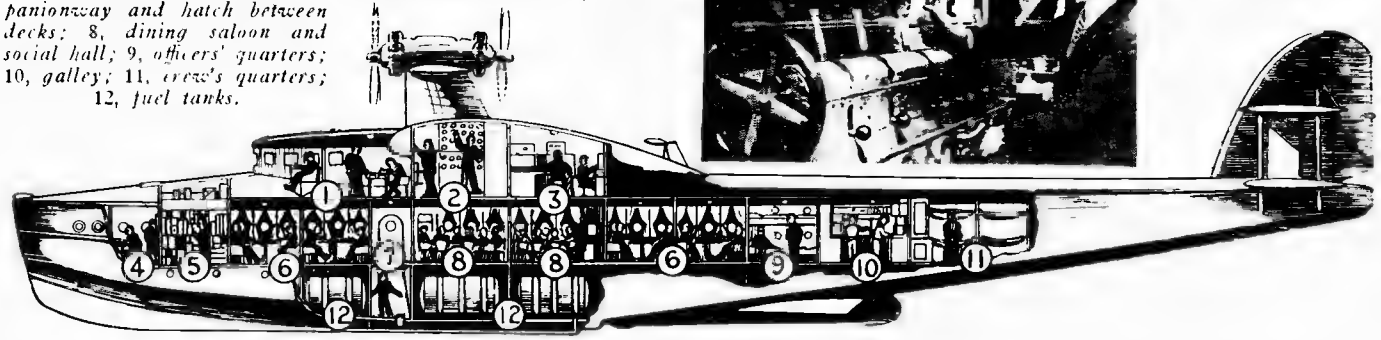


A top view of the 12-motor Dornier flying boat now undergoing trial tests.

On this board one can immediately see how any one of the motors is acting.



Here is where the D. O. X. is controlled.



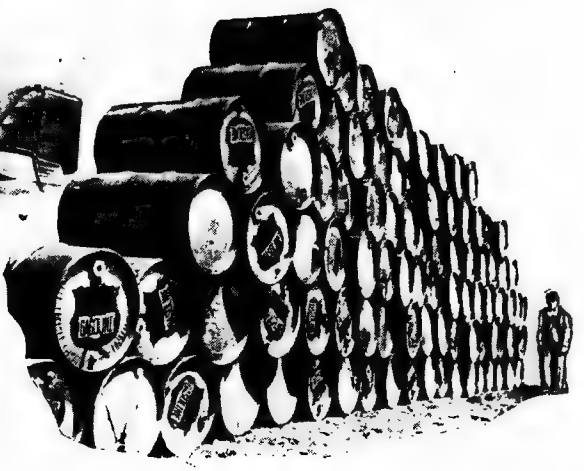
Interior view of world's most massive airplane. Numbers refer to 1, pilot's compartment and bridge of captain and navigator; 2, engine control room; 3, radio room; 4, commander's quarters; 5, baggage and store room; 6, passengers' cabins; 7, companionway and hatch between decks; 8, dining saloon and social hall; 9, officers' quarters; 10, galley; 11, crew's quarters; 12, fuel tanks.

25,000 MILES WITHOUT LANDING

ALL world records for flying an airplane by refueling from another plane in midair were recently broken by Dale Jackson and Forest O'Brine, when they flew their plane, the *St. Louis Robin,* over a continuous flight of 420 hours, 21 minutes and 30 seconds, exceeding by more than 173 hours the previous world's record for endurance flights set on July 12th at Culver City, California, by Reinhart and Mendell. The new record was established at St. Louis.

Risky moment in midair when one of the pilots of the "St. Louis Robin" had to crawl out on a cat-walk to repair the engine. Unusual credit is due to these endurance fliers, as they must possess daring as well as strength and skill.

If the "St. Louis Robin" had flown in one direction, it could have encircled the globe.



Gasoline and oil! This picture gives you some idea of the tremendous amount of gasoline and oil used in such a remarkable 420-hour flight as that of the "St. Louis Robin."

Can You Answer These Science Questions?

THE following questions on general science can be answered, if you have carefully read the articles appearing on the pages mentioned. If you have read these articles, then you will find it a good test of your memory to try and answer the questions before turning to the page numbers cited. If you have not already read the articles, you will undoubtedly find it very worth while to study the articles referred to, for the very good reason that practically no one today considers themselves well read unless they possess a fair knowledge of scientific subjects. Here are the questions:

1—How long did it take the new German steamship *Bremen* to cross the Atlantic Ocean? See page 488.
2—In what way would an airplane help to fight a fire in a tall city building? See page 490.
3—Does the *Graf Zeppelin* carry one or two kinds of gas? If so, what is the purpose of the second gas carried? See page 491.
4—By what electrical means does a passenger on board the the new German ship *Bremen* ascertain how to get from one point to another on the ship? Does the *Bremen* burn oil or coal as fuel for the boilers? See page 494.
5—How many tons of dirt are there in the atmosphere of a large city like New York on a clear day? What is your definition of dust? See page 510.
6—How are "storm effects" produced in larger motion-picture scenes such as those appearing in "Noah's Ark"? See page 503.
7—How many passengers does the world's largest seaplane carry? How long did it take to build it? See page 515.
8—What simple apparatus would you employ in order to see the whirling blades of an electric fan as if they were standing still? See page 534.
9—Where and what are the "crawling deserts"? What is a "Geoduck" and how are they hunted? See page 502.
10—Did you know that there is a new drink cooler which operates by means of chemicals? Did you ever see a gear drive for machines, the gear teeth being formed of ball bearings? See page 506.
11—Name five reasons why you think preventable accidents occur in coal mines. See page 507.
12—What railroad is interested in building a gigantic new bridge across the Hudson River at New York City? How many railroad tracks will this bridge carry? See page 492.
13—How can a beam of light be made to control machinery, that is turn it on and off? See page 511.
14—How did the late Emile Berliner solve the problem of eliminating reverberation or echoes in auditoriums? See page 512.
15—As is well known, sea water contains a small percentage of salt. Would you conclude from this fact that the interior of an iceberg is salty? See page 500.
16—How would you grow new plants without the use of seeds? See page 518.
17—If you were asked to make simple home "talkies," how would you proceed to solve the problem? See page 522.
18—Did you know that compressed air can be made to lift water from great depths in a very simple and economical manner? See page 524.
19—If you had to machine or turn a piece of metal which was too large to swing in the lathe at your disposal, how would you proceed to accomplish the task? See page 529.

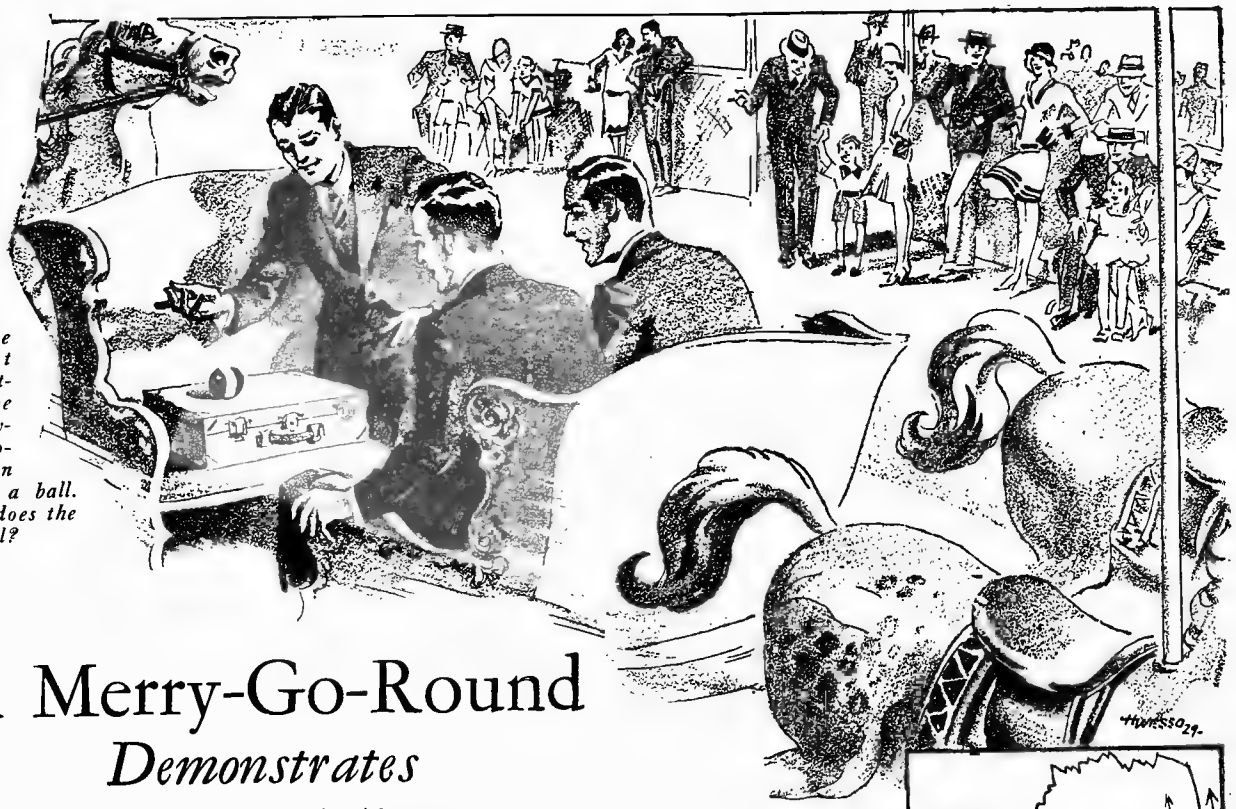


Fig. 1—The relativist places a suitcase on the seat of a moving merry-go-round. On this he puts a ball. Which way does the ball roll?

A Merry-Go-Round *Demonstrates* Einstein's Theory

By Donald H. Menzel, Ph.D.

THE reader will recall that we left our three relativistic friends in an amusement park, where they were finding out that the theory of relativity is by no means out of their experience.

Layman—Although I have followed your reasoning closely, there is always a little voice in the back of my mind that says, "Why bother with relativity? Isn't simple, old-fashioned gravitation good enough for you?" After all, it doesn't make very much difference does it?

Relativist—I can sympathize, although I do not agree with you. Until now I have scarcely dared to make this statement, for fear that you would laugh at me. But here goes. Relativity is really more simple than gravitation!

L.—Astounding!

Physicist—That's a new one to me. I have heard it said that the Einstein theory is so difficult that scarcely a dozen men in the world can understand it.

R.—That last is all talk, of course. The real difficulty with relativity is not its apparent complexity but its newness.

Recall how the contemporaries of Columbus ridiculed the idea of a spherical earth. "Do the people at the Antipodes walk on their heads?" they asked. Only the other day I overheard two negroes arguing on a street car. One of them, apparently just returning from some scientific lecture, was saying, "Imagine him insultin' mah intelligence by sayin' that the earth is roun' like a ball an' spinnin' like a top. Imagine tellin' *me* a thing like that. If we's on top of the earth now, why in twelve houahs we'd be hangin' head down, an' tell me—why don't we fall off!"

P.—If the question were put to popular vote throughout the world, there is no doubt but that the returns would be overwhelmingly in favor of the ancient idea that the earth is flat.

R.—And what percentage of those that cast their vote for the spherical earth have anything more than a blind belief that it resembles

(*Continued on page 550*)

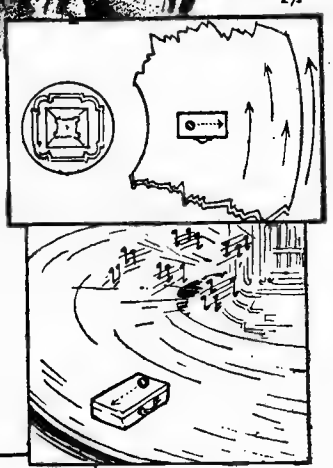


Fig. 2 at right.

Fig. 2—The ball on a rotating merry-go-round tends to move directly away from the center and in a straight line relative to the suitcase. Centrifugal force might be explained as attraction from outside or repulsion from center.

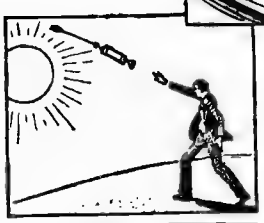


Fig. 6—A rock and scale are thrown so as to leave the earth. Scale registers zero.

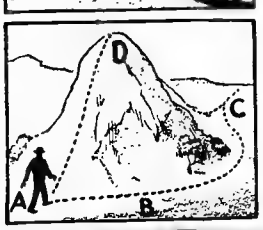


Fig. 7—Anyone would prefer the path ABC to the straighter path, ADC. Why?

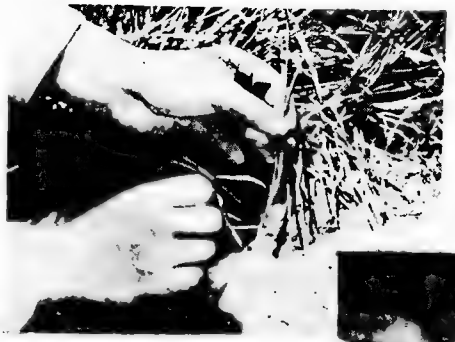
Fig. 3—One might conclude that band at center was repelling ball.

Fig. 4—If, as illustrated at left, the scenery were painted on a background that could be rotated backward, anyone "riding" on the merry-go-round would think that he, rather than the scenery, is moving.

Grow New PLANTS

Garden Plants Easily Propagated

By the Eminent Authority



Left, the split end is sunk into the ground.

Right, propagating carnations. Split carnation stem from node to node.

Here the stem is being held in position by means of a small forked stick.

PLANTS are usually multiplied and raised with seeds, and many of them come true to type, but there are many other plants so highly cultivated that it is impossible to use their seeds, for such plants would then be degenerated and go back to their wild form. In order to prevent such an occurrence, other methods of multiplying plants must be found, and, by experiments through the ages, two types of propagation without seeds have been developed. These are grafting and propagation through cuttings.

The method of propagating plants with cuttings is one of the most peculiar problems of the plant grower, not because it is so difficult, it is simple, but because each type of plant requires a little different method for its successful completion. At present only certain plants may be multiplied by this method. Further experiments along this line will undoubtedly increase the number of plants that may be so treated.

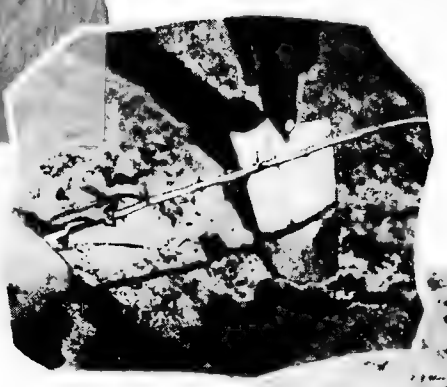
Left, a shoot of Pelargonium being prepared as a cutting.

Above, shoot is sunk into the ground and held with a stick.

Placing cuttings of privet in a ditch.

It was not so very long ago that a method for propagating hybrid carnations was developed. By this means any form of carnation may be kept true to its type, a condition almost impossible when they are raised from seeds, as they are much too variable in form, color and shape. The cuttings are made from strong flowerless shoots during July or August. With a sharp knife the shoot is split from one node to another. This forms a tongue. The shoot is bent to the ground into a slight excavation and is held in position with a small twig having a hook at its end. The tongue is kept vertical and the depression is filled with soil. This cutting is still united with the mother plant and it receives its nourishment from it. The other end or tongue will develop roots in about four to six weeks. Then it may be cut from the mother plant and kept in pots in some frost-free room or cellar during the winter. It is transplanted out of doors in the spring. During root formation any flowers that may develop should be pinched off.

The propagation through cuttings also enables one to quickly obtain large and well developed plants in a comparatively short time. The Pelargonium, also wrongly known as the Geranium, is usually transplanted from the garden into pots and placed in a frost-free cellar or room. At this time the shoots are pruned back, the mature shoots being used as cuttings to propagate the plant. These are placed in light sand in a hotbed, and if a hot bed is not available, then they are placed in large flower pots, the cuttings being placed near the edge of the pot, at which point they will produce roots more readily. Keep the soil slightly moist and cover with a glass globe, keeping the dish away



Propagating gooseberry. Girdle the gooseberry twig and dig a shallow trench.

Place twig in the soil, cover with soil and hold twig with forked stick.

Without Any SEEDS

System of Cuttings and Layering Explained

DR. ERNEST BADE

The rooted gooseberry is cut from the mother plant and transplanted.

Notch the leaf of Bryophyllum.

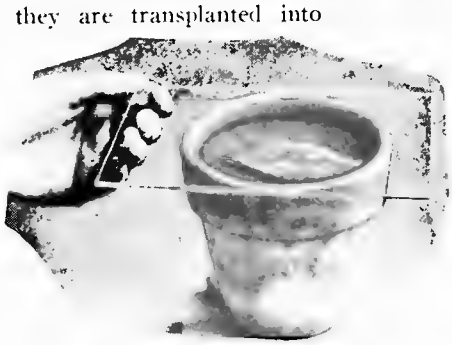
A branch of Tradescantia is used as a cutting.

from the sun for the first two weeks. When the cuttings have rooted they are transplanted into small pots.

A cutting will produce its roots most readily when it contains a comparatively large amount of reserve food and when it is planted as soon as possible after cutting. The only exceptions to this rule are the various plants containing milky or resinous saps such as the succulent cacti. These plants must dry their cut surface before they may be planted, and this may take a few days. It is best to dry the cut in the sun, and, when dry, it is placed into soil which should not be too moist. This is the most rapid method of propagating such types.

A number of trees will also grow from cuttings, probably the best known that will do this are the willows and poplars. The time to make cuttings is early in spring before the leaves begin to grow. Cuttings may be a few inches in length or they may be a few feet long; in fact, freshly cut poles sunk into the ground root just as easily as the smaller cuttings.

Many bushes and shrubs may be multiplied by this method. Here shoots a foot in length (*Continued on page 568*)



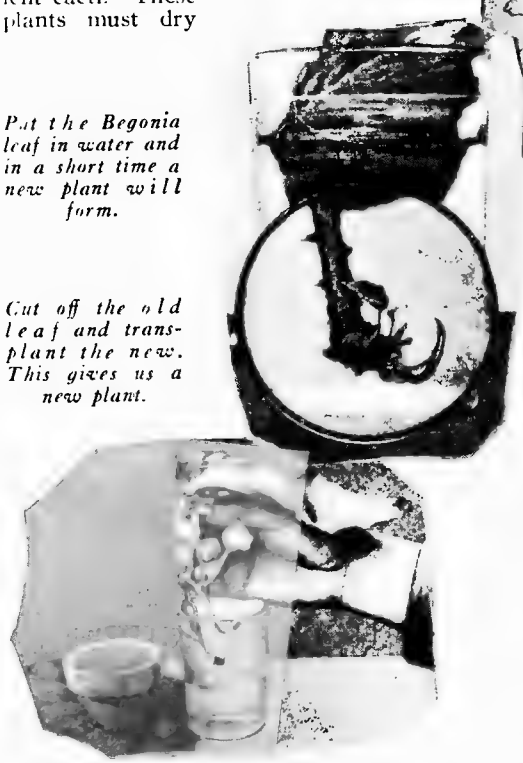
New plants develop from this one notched leaf.

Place Bryophyllum leaf on soil in a flower pot and cover with glass.

Cut off the leaf of a Begonia.

Put the Begonia leaf in water and in a short time a new plant will form.

Cut off the old leaf and transplant the new. This gives us a new plant.

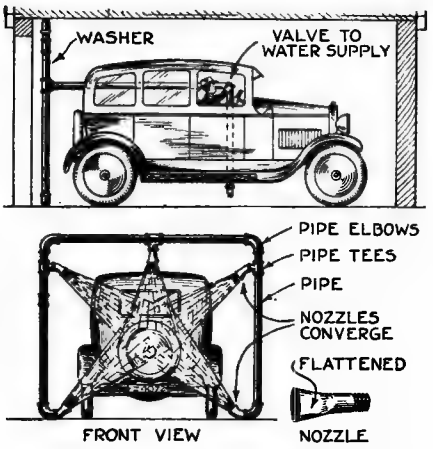


The Cutting and Layer Method of Getting New Plants for Old

Cuttings to Be Placed in Water	*Cuttings to Be Placed in Shady Places*	*Layers, Branches Hooked to the Ground and Covered with Soil*
Coleus.	Boxwood.	Gooseberry.
Begonia rex.	California privet.	Currant.
Oleander.	Willow.	Rose.
Rubber tree.	Poplar.	Grape.
	Pelargonium.	Flowering bushes.
	Cactus.	Carnations.
	Tradescantia.	Barberry.

Motor Hints

Conducted by George A. Luers



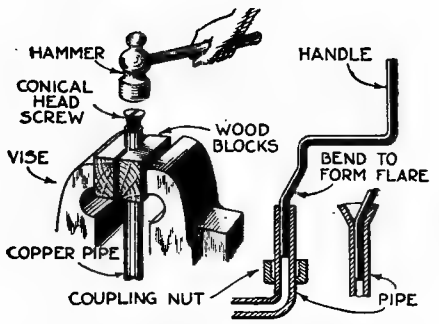
Car washer installed in the garage.

Labor-Saving Car Washer

A BETTER method for washing was recently installed in a private garage. At the entrance to the garage a pipe line was connected through a valve to the water supply. This pipe runs along each side and across the top. Five nozzles are arranged to converge the water. These nozzles are simply pipe with flattened ends. The car is driven slowly through this stream of water, which reaches practically all the surfaces of the car. If the car is very dirty, it is sponged over after the first rinse, with soap and water, and then driven through the washer. Usually, however, daily baths with this washer are sufficient to remove the dust.

Flanging Copper Pipes

THE flanging of pipes for connecting joints in oil or gasoline lines is simple enough if the owner selects the proper tools. Two examples of how to flare pipes are shown in the sketch. The first of these is a flare made by clamping the pipe between two blocks and tapping on a conical head wood or

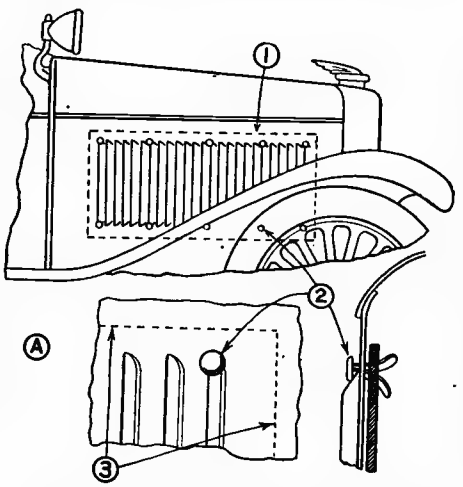


Showing two methods of flanging copper pipes.

machine screw, thus forcing the metal to flare outward. When it is not convenient to remove the pipe, it is possible to select a piece of steel having a diameter of that inside the pipe. This is bent as shown in the sketch. Holding the pipe in one hand and the tool in the other, the tool is rotated as an auger. This creates a good flare by a sort of spinning process. Avoid the use of twine or makeshift "leak" seals. A proper flare makes a business-like job.

Close Engine Hood in Winter

HERE is a quick and ready method to retain engine heat in winter, keep snow and rain out of the distributor, off tires and off the carburetor and to insure ready starting. Two pieces of dense fiber board, large enough to cover the louvers in the engine hood sides, are secured with brass paper fasteners. The fiber board is preferably a heavy grade, such as is used for car-

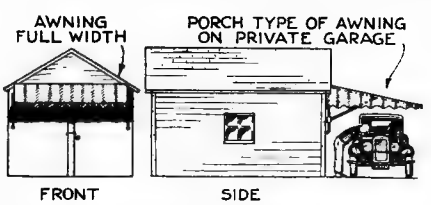


The closures installed, showing how they are fastened.

tons and shipping packages. The paper fasteners hold this tight inside the engine hood, so that the paper does not show except through the apertures. The board may be tinted some color that will blend with the trimming of the car, adding a touch of color.

Awning for Your Garage

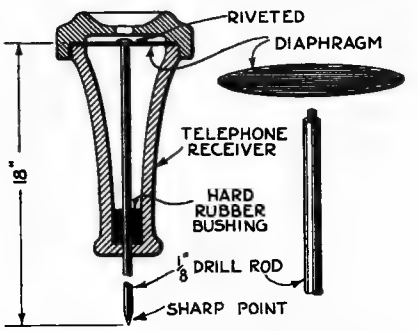
THE intense heat while working in a private garage during the hot months and unhealthy fumes from running the engine may be avoided by equipping the garage with a large awning. Oiling, greasing, and adjusting may be done under this awning.



Awning installed on the front of the garage.

This is a distinct advantage for washing the car in the open as the sun will not beat down on the car and cause uneven, streaky drying. An awning of the same colors as those used on the home adds to the completeness and attractiveness of the surroundings.

Stethoscope Spots Engine Noises



Stethoscope for locating engine noises.

A VERY sensitive form of a stethoscope can be made from the ear piece of a telephone reconstructed as shown. The electrical parts of the receiver are discarded, and in place of this a small steel rod, about one-eighth inch in diameter and eighteen inches long, is secured to the metal diaphragm, by riveting. The detecting end of the rod is led through a hard rubber plug at the end of the ear piece. The rod end is made sharp or pointed so as to penetrate paint and grease. Care should be taken not to allow the rod to be bent.

Fixing Broken Door Handle

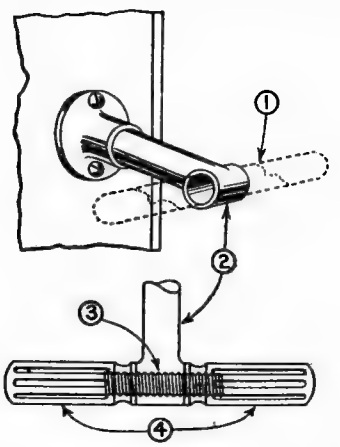


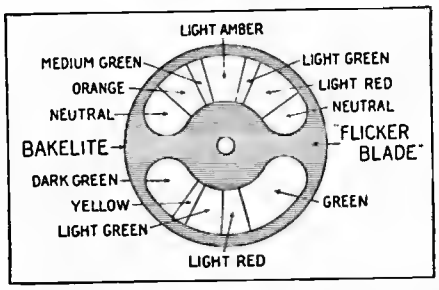
Diagram showing how door handle was repaired.

A BROKEN handle on a closed car may be repaired as follows: Saw off a short length of threaded stem of a tire valve. Obtain two nickel-plated valve dust caps. File out the hole in the door handle knob slightly to accommodate the threaded stem. The dust caps are screwed on each side to complete the repair. This improvised handle makes a good emergency repair job, but it will serve the further life of the car if desired.

HOME MOVIES

How Filters and New Color Attachment Enable You to Capture True Color Values

By Don Bennett



Vitacolor camera filter, which you attach to the movie camera when taking pictures that are to be reproduced in color.

Taking pictures on a home movie camera with the Vitacolor filter. The color filter adds little weight and is so compact that it does not interfere with the easy operation.

Standard home movie projector with the Vitacolor projector filter attached. Without this filter attached, the pictures would appear like any ordinary pictures in black and white. The new filter adds the color.

DO you recall those snapshots you have made of beautiful autumnal foliage, a veritable riot of color, and the prints showed only a mass of gray or black, with no distinction between the shades or the colors?

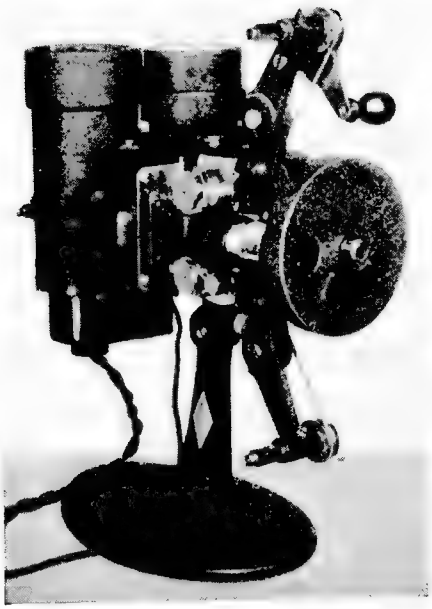
Would you like similar pictures that showed every little gradation of tone, the gradations between parts of a single leaf even, parts that vary from green to red, with all the shades between? Even though your pictures are still black and white, therefore *monotone*, you can have gradation of that monotone that will give you a beautiful scene.

Of course, for those amateurs fortunate enough to have color equipment on their movie cameras, autumn presents an opportunity out of the reach of the "still" man, unless he possesses elaborate equipment and experience for the making of color plates, and he is not always sure of his results.

George Blake, advisor-at-large to the Rockland Movie Clubs, was asked to deliver a talk on capturing colors in black and white:

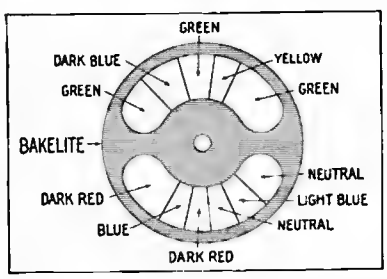
"The prime necessity in getting true color value is panchromatic film. The use of this film with the proper filters assures as nearly a correct rendition of color in monotone as is possible. An elaborate set of filters is not necessary. Some amateurs make out with only one filter, graduated in density from zero to a factor of about three times. These filters come in various densities, and the second grade is a good filter for all-round outdoor work. This provides a range as specified above and is equivalent to the plain filters up to K2. For special effects, other filters may be used; there are almost four hundred to choose from.

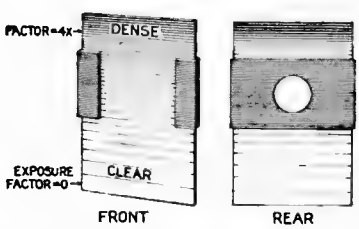
The most common type of filter in use.



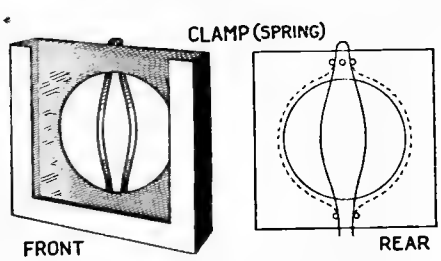
No alterations are made in the home movie projector to show colors, except to add a Vitacolor filter.

The projector filter is like the camera filter, except that the colors are arranged differently.





Graduated filter and holder which fits over the lens of the camera.



Holder for square filters. The spring clamp fits over the lens and filters slide in the frame.

"Perhaps an explanation of the filter factor is desirable. These factors, always given with a filter or in the catalog of the manufacturer, refer to the increase over normal exposure that must be given when the filter is used. For example: your exposure meter calls for an exposure of f11. You decide to use a 2x filter, requiring double the exposure. Doubling f11, we get f8, the proper exposure with a 2x filter."

"Mr. Blake, why do you say f8 is double the exposure of f11?"

"Because every stop is approximately twice the exposure of the next smaller stop. The rule is, that the relation between stop numbers shall be inversely proportionate to their squares. If we square 11 we get 121, and the square of 8 is 64, approximately half but photographically twice as large. It is safe to assume that every stop mark on your lens represents twice the exposure of the mark next higher numerically."

"What would the correct exposure with a 4x filter be, Mr. Blake?"

"For a 4x filter we would again double, getting f5.6. The square of 5.6 is 31.36, which is nearly half of 64. If the filter factor were three instead of four, we would have the difference between the two, f8 and f5.6, and our exposure would be in the neighborhood of f6.3.

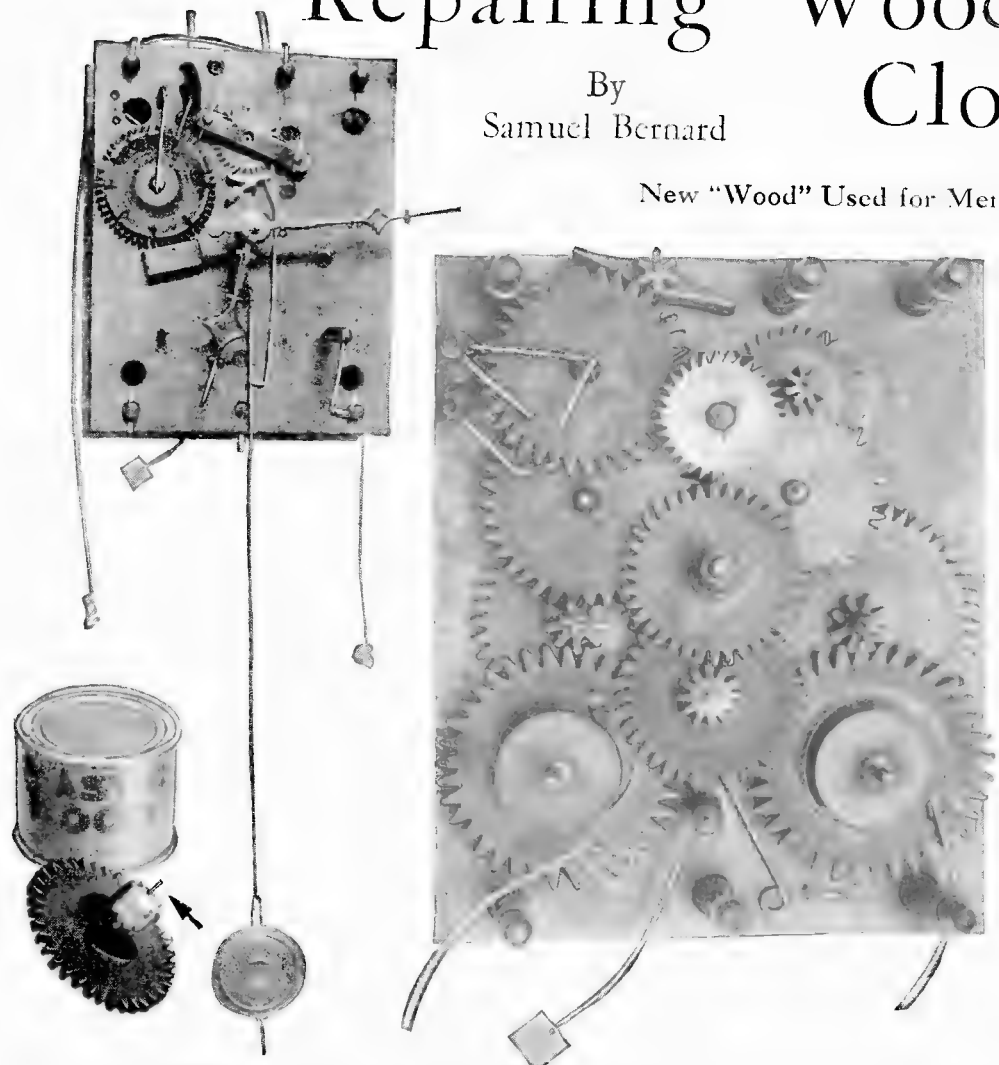
"For convenience, I will give you the stops from the smallest to the largest with the squares so that the relation is apparent: For the amateur movie enthusiast who really wants to get the best photographic results possible, it is highly essential that he thoroughly understand this matter."

(*Continued on page* 567)

Repairing Wooden Clock Works

By Samuel Bernard

New "Wood" Used for Mending Old Movements



The old clock movement shown above is made entirely of wood and was repaired by using a preparation which when thoroughly dry resembles wood. This compound can be used for making all sorts of repairs on wooden objects. The writer repaired the clock with this plastic wood which can be molded easily.

THIS old clock movement, made of wood—the wheels, the plates, the whole "works"—has been ticking off the minutes in American history since the days of Adams and Jefferson and Hamilton. The teeth of a couple of wheels, and the leaves of a couple of pinions were broken off. The owner of this clock was anxious to have it repaired—it was his family heirloom for more than four generations. But every watchmaker in New York to whom he brought the clock for repairs turned him down—they did not want to "fool" with it. None of them evidently knows that there is a sort of plastic wood that is an invaluable aid in repairing and strengthening wood of every description, and that holds equally true with the old wooden clock.

During the early development of devices for telling time, there were clockmakers developed from priests, blacksmiths and locksmiths. A locksmith, by the way, Peter Heinlein, invented the first watch. He made it possible by substituting a coiled mainspring to drive the geared mechanism, and thus discarding the brick or stone they used for motive power.

In the early days of American history, when wood was plentiful, and the carpenter was the general mechanic, and who had frequently to make cases for clock movements imported from England or Holland, quite a few highly skilled carpenters set out to make clocks out of wood.

(*Continued on page* 555)

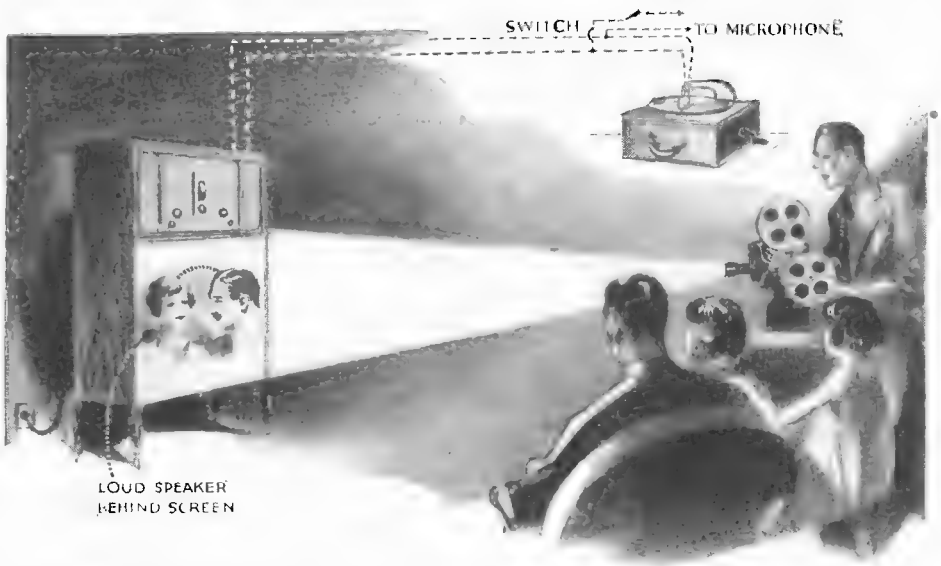
How to Have Talking Movies.

By SAMUEL M. LOVENSTEIN

IT is altogether possible for home movie-makers to produce moving pictures which combine talking and a "synchronized" score. The system used is one that will not require a large output of money, and one that when used properly will give good results both from an electrical and a dramatic standpoint.

The required parts, besides a motion picture camera and a projector, are as follows:

A phonograph, an electric pick-up for the same, a good radio set, a microphone with some sort of switch or an old telephone.



The amateur movie-maker can synchronize his pictures with voice and music as illustrated above. A musical score can be added to any film by merely playing the phonograph record. A microphone can be switched in when desired.

Attach the pick-up to the phonograph, and connect it to the radio set in the usual way—as recommended by the manufacturer. Connect the microphone in parallel with the pick-up; with the switch, if external, in the position shown. Of course, if a telephone is used, the receiver hook will act as a switch to open the "mike" circuit.

(*Continued on page* 554)

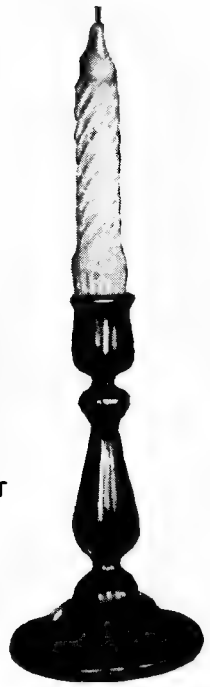
Home Wood Turning Provides Artistic Lamps and Candlesticks

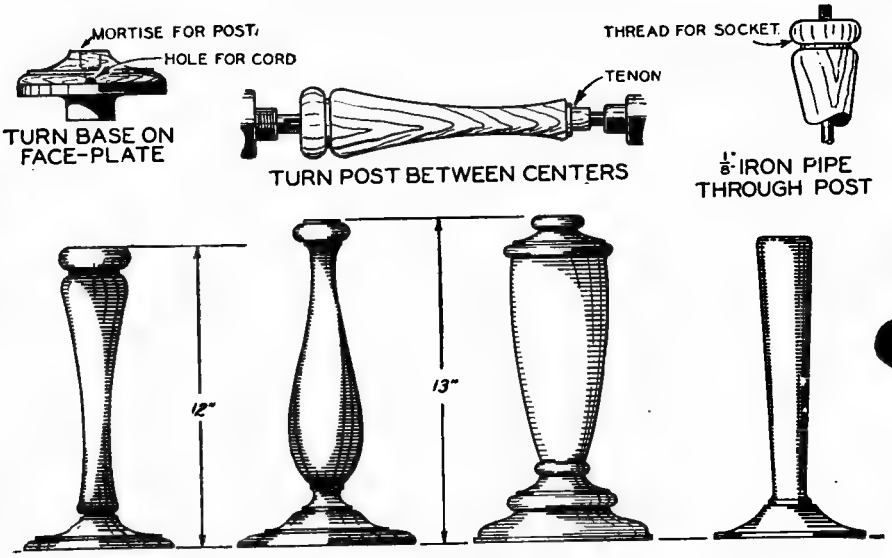
By H. L. Weatherby

Article No. 14 in a Series

A finished wooden table lamp, complete with shade.

A candlestick, similar to the one below, is easily turned.





Various styles of wooden table lamps which are easily turned in the home workshop lathe.

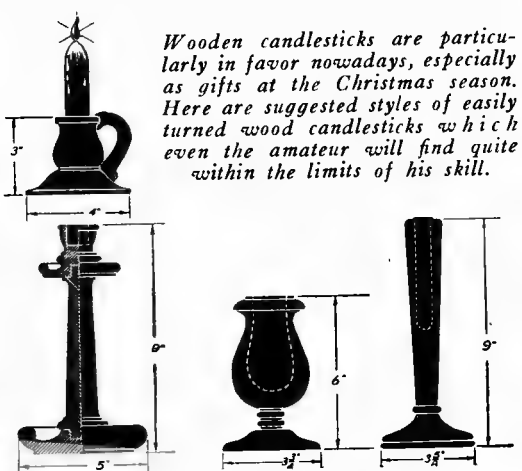
THIS month we illustrate a group of small lamps, a few candlesticks, and two different vases, any or all of which will make very welcome additional home furnishings. In the writer's experience he has never seen a home yet where another lamp could not be used to advantage. Candlesticks are always in good form, on the table or mantle, and the vases will prove to be useful as well as ornamental. They make particularly fine Xmas gifts.

Design in table lamps, as well as other furniture and furnishings, is changing. A few years ago the six-foot floor lamp, with a huge umbrella-like shade, was quite the thing. Now we have the bridge lamp and low floor lamp, with smaller shades to take the place of the ponderous lamp of years gone by. So the style has also changed in table lamps, and the newer ones are plainer, smaller, not so slender in proportion, and the wood is more often painted or lacquered than stained.

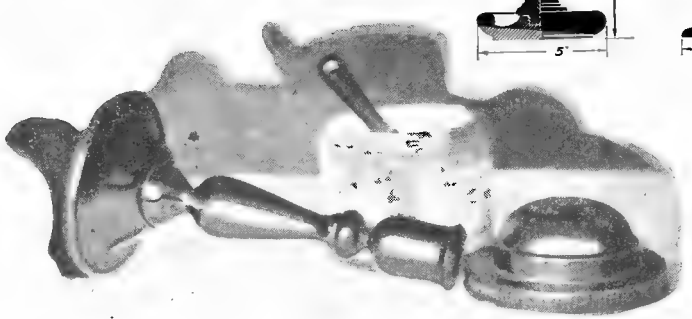
Dimensions, excepting a few general ones, have been left off of the drawings that accompany this article, but the scale is indicated. Before beginning work on any one of these pieces, take a narrow strip of paper and lay off the scale exactly to the size that is in the magazine article. Using this, measure each part of the drawing and make a full-size half sketch on a sheet of white paper, using a soft pencil. Fold this half over and transfer the other half by rubbing over the paper back of the lines, thereby giving a full pattern to work by. Measurements can be calipered directly from this pattern.

The lamps illustrated are to be constructed in two parts, as the drawings indicate. The base should be turned from a block fastened to a face plate, while the post is turned between centers. A mortise is turned in the base and

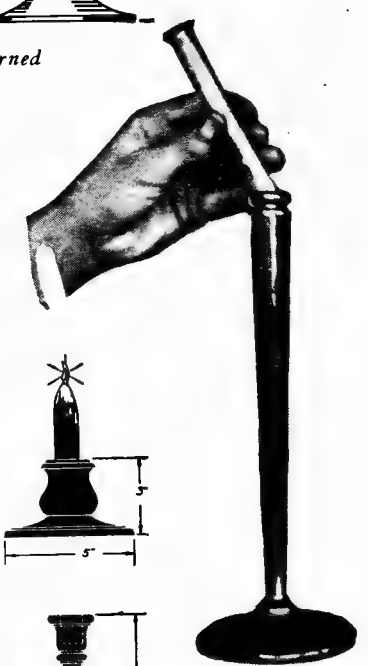
(Continued on page 572)



Wooden candlesticks are particularly in favor nowadays, especially as gifts at the Christmas season. Here are suggested styles of easily turned wood candlesticks which even the amateur will find quite within the limits of his skill.



Glue or paste felt to the bottom of any of the articles turned, and trim the edges with scissors after it has dried. In many cases a lead disc should be fastened to the base under the felt to give stability.



It takes a glass test tube to make a vase of this kind. The vase is turned in the lathe by the wood-worker. Pleasure and profit combined may be realized by the wood-turner.

Making An Air Lift Pump

The Air Lift System for Deep Wells Is Not Unknown, but Its Use Seems to Be Confined to Certain Limited Sections of the Country. It Is Exceedingly Inexpensive, and One That a Practical Man Can Build for Himself

By L. B. ROBBINS

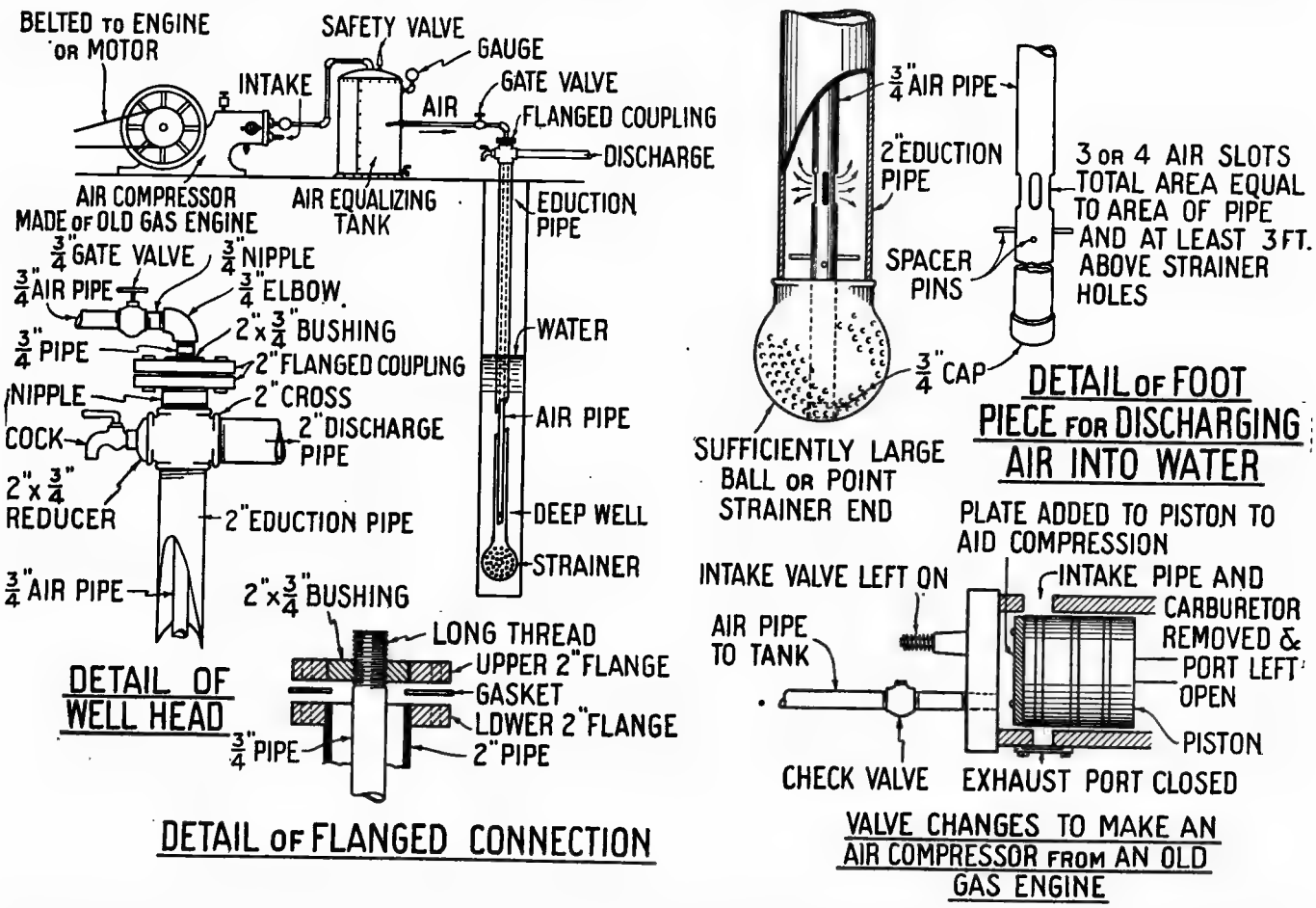
DEEP wells require heavy pumps, powerful engines and complicated piping systems where regular pumping systems are resorted to, and these all mean great expense and many moving parts to care for. While probably the efficiency of the air lift system is not so great as the pump system, yet its simplicity has a certain appeal and the rural dweller can raise water from a considerable depth with but little complicated machinery. The discharge must be lifted either to an overhead tank or to a sump; pressure tanks cannot be used. A few pipe fittings, a small gas engine, a discarded stationary or motorcycle engine, belting and a tank capable of holding up to 100 lbs. of compressed air comprise the main features of such a system. The principle of the system is simple. It consists merely of forcing air down to the water and forcing the latter up a pipe to the reservoir arranged for it. By following the instructions, it should be possible to build such a system for only a few dollars against a much larger price for a regulation pump system.

The Air Lift System

THE system in general consists of a large diameter pipe extending down to the bottom of the well. Inside it is suspended a second smaller pipe connected to the air-pressure tank on the surface. This is filled by an air compressor operated by the gas engine. When air is injected from the tank to below the level of water it pushes a column of water up the larger pipe to discharge it into the tank above. These diagrams are drawn with the idea of lifting water from a deep, open well. With a driven well it will only be necessary to substitute a drive point strainer for the ball strainer shown.

The well head is the first thing to consider. For ordinary purposes a 2-in. eduction pipe will be sufficient. First attach the strainer to the eduction pipe and sink it or drive it to the required depth, so a good depth of water stands in the pipe. At a convenient height above ground thread on a 2-in. cross, one side opening to face the reservoir tank. Fit a common pressure cock into the opposite side opening by means of a 2″×¾″ bushing. Thread a 2-in. close nipple into the top of the cross and on top of that the lower half of a 2-in. flange coupling. Then arrange a firm support for this eduction head and pipe and lead a 2-in. pipe to the tank. Of course, a check valve in this discharge line will be of advantage to prevent the supply running back into the well. Run a 2″×¾″ bushing into the top half of the flange coupling. Place the gasket between the halves and then you are ready for the air pipe. The foot piece must be constructed first as follows:

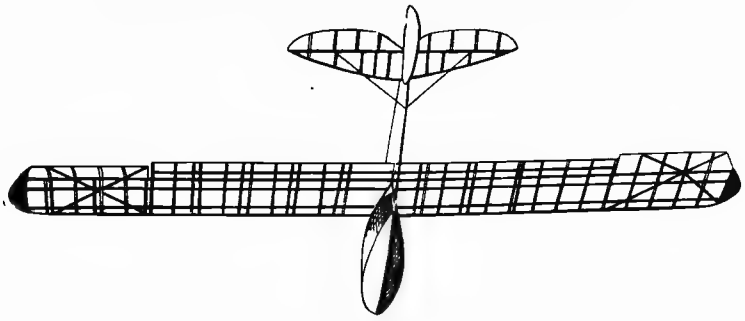
Cap one end of a length of ¾-in. pipe. Then, at a distance above the cap, at least 3 ft. greater than the height of the end of the eduction pipe above the strainer top, cut 3 or 4 slots for air outlets. Their (*Continued on page* 560)



Here are shown the details for building an air-lift pump for deep wells. As will be observed, there are two pipes; one within the other, the compressed air being forced out of the open end of the inner pipe, and on rising to the surface, it carries the water in the outer pipe with it. In driven wells the only change necessary is the substitution of a sufficiently large strainer at the bottom of the outer pipe.

New Two-Seater German Glider

Ideally Suited for Training Pilots



Under view of glider, showing large wing spread.

THIS glider, of the Mecklenberg type, was developed by Engineer Krekel and was constructed from the standpoint of a cheap, level ground glider, which also would answer for school purposes and for test flights at low heights with little wind. Above all, the machine was to answer as a two-seater and to be light, in order to have the greatest advantages of a two-seated gliding and school plane. With regard to carrying it back to the starting point, it is necessary for a two-seated machine to be very light when empty.

The machine was built in the workshop of the Mecklenberg Aero Club, in Rostock, Germany. Especially noticeable is the unusual extensive use of thin-walled welded steel tubing in building the plane. The two-seated boat is made of steel tubing, covered with fabric, and is joined to the wing by wire. The cabane strut is also made of steel tubing. The control cables, made of flexible wire cable, are attached to a spindle, which puts it under tension and gives a very easy mounting. The time of attaching is only twenty minutes; the time of detaching lasts but 15 minutes, which is done by dropping the spindle down into the central cabane tube. The time required for freeing the cable from the plane and attaching the plane thereto is very short.

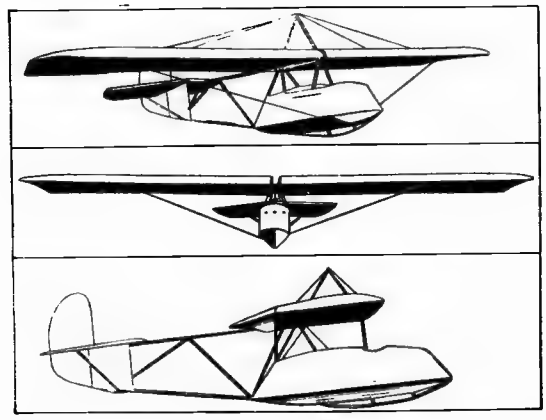
The wing is in two divisions and is made of wood, veneer and fabric with two cross-beams. The beams are made of high, narrow boards with holes sawed out on the neutral line, in order to reduce their weight without diminishing the strength. The ribs are 1.6 inches apart. The rudder has a differential scheme of control.

The elevating plane and the rudder are made of steel tube construction. The pin is made out of wood. The steering is a normal, double steering, with duraluminum joy stick. Side steering is carried out by pendulum action.

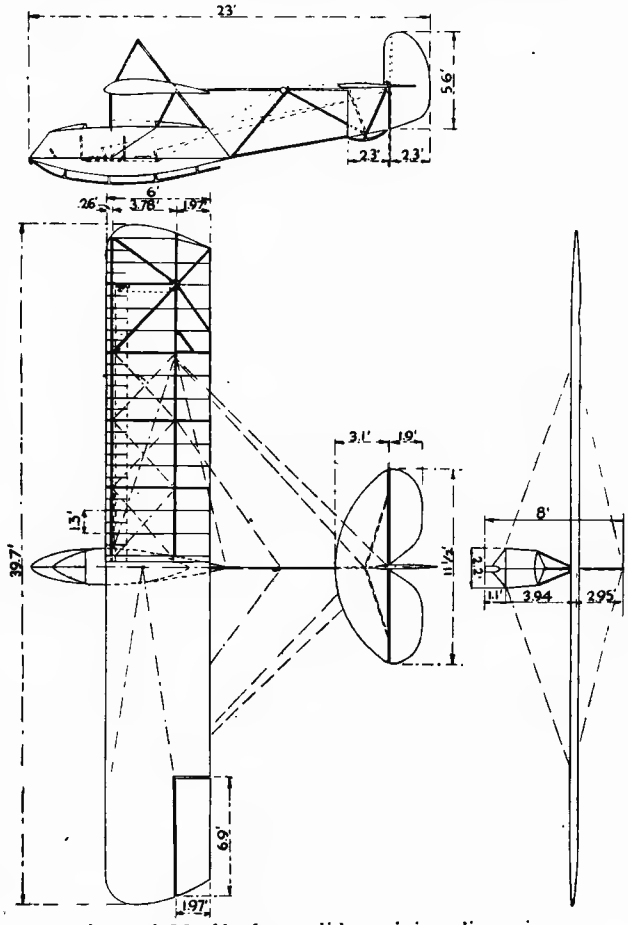
The central skid is of ash and is strengthened by steel tubes and has India rubber cable attachment.

The principal measurements of the machine follow. If the reader has read the article on glider construction appearing in the June and July issues, he should find no difficulty in constructing this machine.

The weight unloaded is 209 pounds. The width is 39.7 feet. The length is 23 feet and the height is 8 feet. The area of the sail is 226 sq. ft. The depth of the wings 6 feet. The ratio of the sides 1:68.



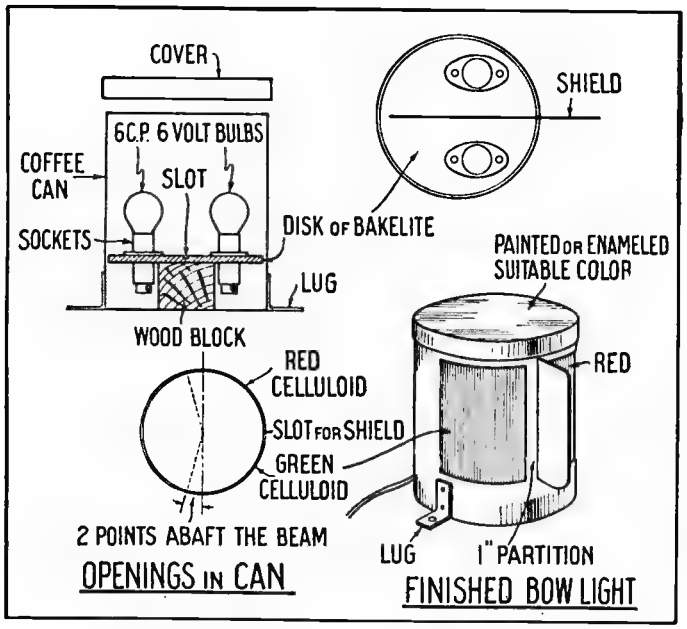
Several views of the Mecklenberg glider, giving a good idea of its general design. The diagram at the left gives some idea of the rib construction and fuselage suspension.



Plans of Mecklenberg glider, giving dimensions.

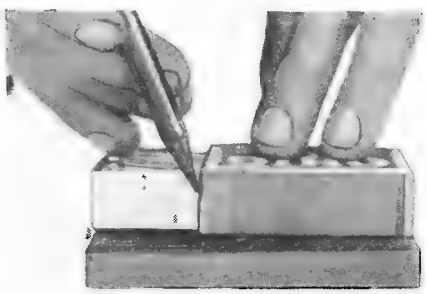
The two pictures below show a single-seated glider of the Mecklenberg type that is manufactured in the United States and which sells for a very reasonable price. The pilot, a former German glider enthusiast, is ready to test the machine.

How to



Running Lights for Small Boats

ANY small boat owner can build a set of port and starboard running lights, at very little expense, and they will be found to be serviceable in fair weather or foul. The covers for the lights are made from coffee cans, or any clean can the right size.

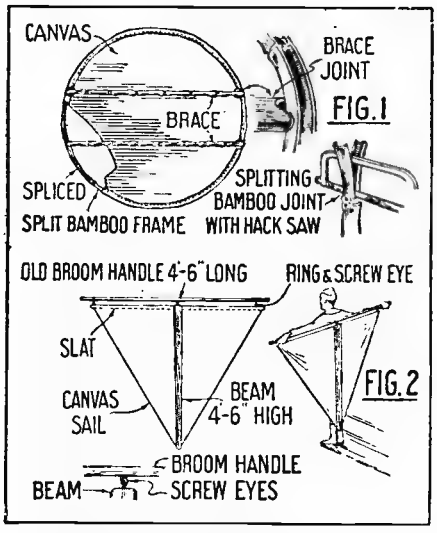


Match Box Used as Measuring Tool

A SMALL safety match box forms a convenient tool for measuring small distances and openings. If the distance is short, lay the box down and slide the tray out to the limits desired. Mark the dimension with a pencil on the side of the tray, against the edge of the box. If the distance is greater than the tray and box, take the length of the box first as part of the measurement, laying it down again and sliding the tray out to get the distance accurately. The distances may be compared with a rule if necessary.—*L. B. Robbins.*

Tangle-less Iron Cord

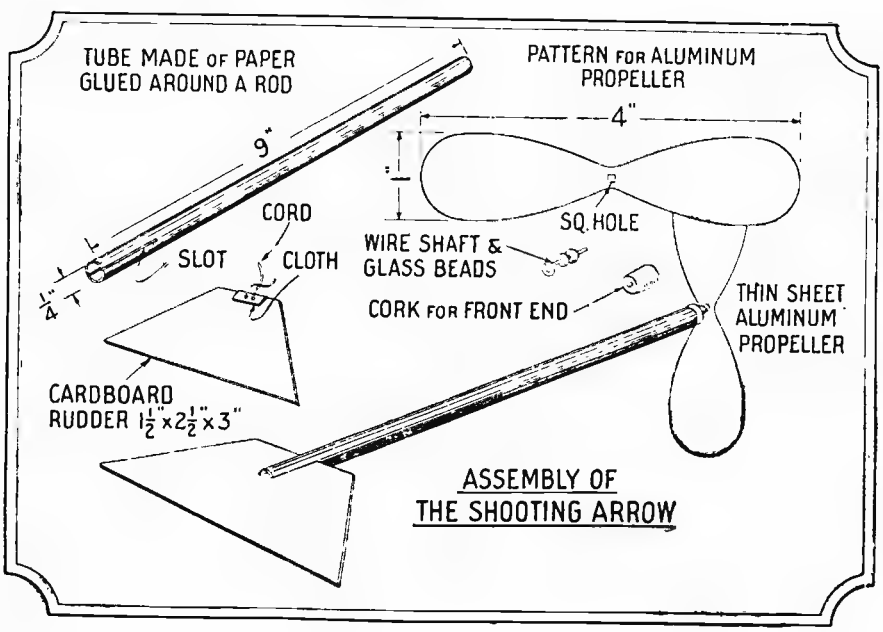
RUBBER bands looped together to form a chain about two feet long make a simple help for ironing day. The free ends of the chain are attached to the iron cord and plug with pieces of string. This arrangement is applicable to other electrical appliances. — *W. E. Burton.*



Constructional details of the two sails and the method of using them.

Ice Sailing Hints

IT'S fun to sail on the ice! Here are the constructional details of two types of ice sails to be used with ice skates. The triangular sail may be constructed so that it can be rolled up, but the circular sail is lighter, more rigid, and more effective because of its greater area exposed to the wind. The bamboo should be soaked a few hours to make it pliable.—*D. R. Van Horn.*



A Toy Helicopter

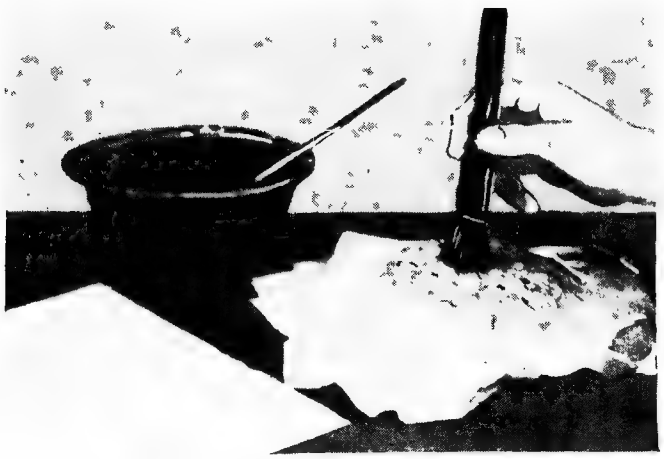
A TOY that will rise fifty feet or more over the spot from where it was launched can be quickly and easily constructed from readily obtainable parts. The construction of the propeller is important. Care should be taken to see that the two blades are balanced. The whole helicopter may be lightened by using a celluloid propeller. The toy will then rise much higher on the same power. The power depends on the rubber band. From fifty to a hundred turns can usually be made in winding the propeller with an ordinary rubber band. A stronger band will permit a proportionately greater number of turns and the toy helicopter will go higher into the air. They have been known to rise as high as 150 feet.

The aviation student may well experiment with helicopter models, for the very good reason that the future aircraft will undoubtedly be based on the helicopter principle.—*D. R. Van Horn.*

Make It!

Plastic Objects from Paper

PLASTIC objects can be made from paper so that they resemble ornamental details made from plaster of Paris, metal or even wooden carvings. These plastics from paper may be painted, varnished or, in fact, treated any way desired by the maker.—*Dr. E. Bade.*

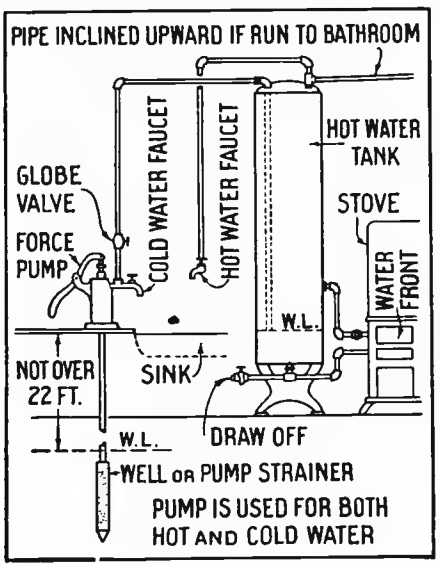


Each sheet is pressed in separately and the whole is dried under pressure. When dry, the protruding edges may be cut as desired.

Moist sheets of paper are placed over the mold. Dilute glue is spread between each layer. Sufficient paper is put on to fill the cavities.

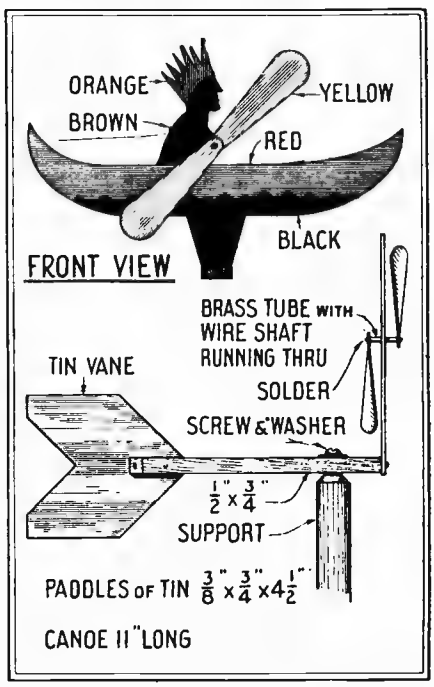
Hot Water for the Farm

A HOT-WATER system that may be used where running water is not available is shown. The force pump supplies hot water as needed from the reserve tank, at the same time replenishing the water to be heated.—*L. B. Robbins.*



Amusing Toy Windmills

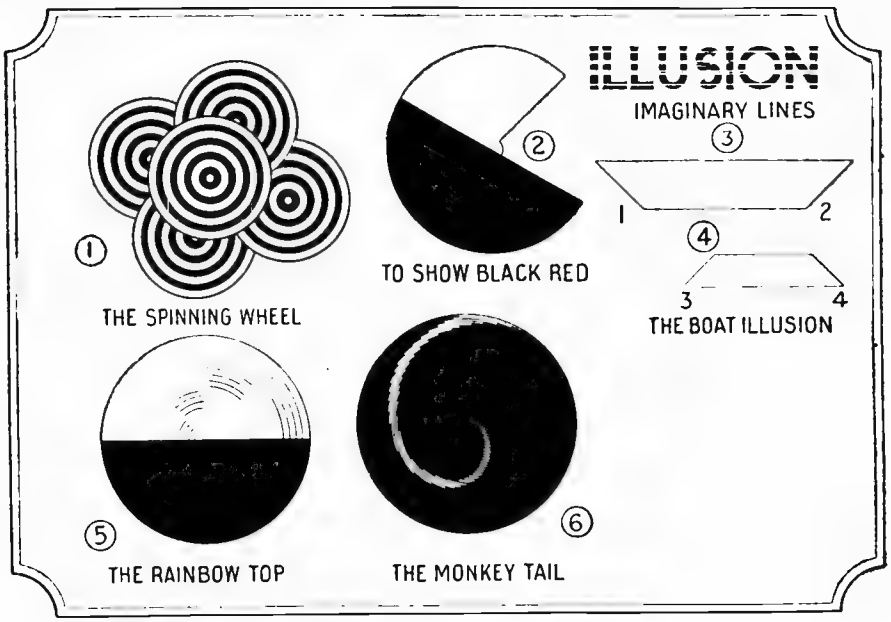
WHY not make your next toy windmill one that gives some amusing action? The diagram shows an Indian that paddles his own canoe. The blade of the propeller acts as the paddle. The parts are made from heavy galvanized sheet iron. The design is drawn on paper and then traced on the iron with tracing paper. The whole is painted to suit. Many other amusing arrangements may be worked out with a little thought.—*D. R. Van Horn.*



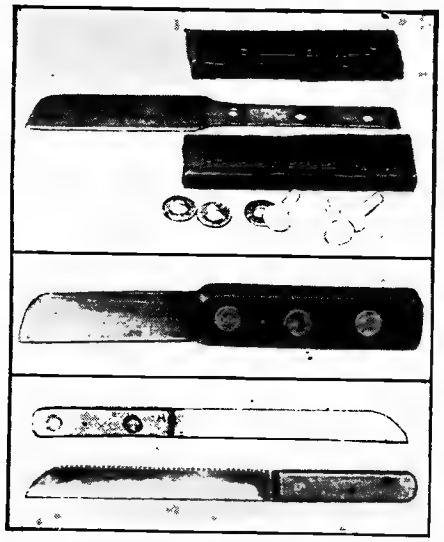
Constructional details for the windmill. The effect is that of the Indian paddling.

Optical Illusions

THE disks in No. 1 begin to turn when the page is moved in a circular motion. Spin No. 2 over black type and it will appear red. In No. 3 white lines transverse the black letters, but appear as continuous white lines. Which is longer in No. 4? 1—2 or 3—4? Spin the disk in No. 5. The outer parts appear blue and the inner portion red. The "Monkey Tail" in No. 6 is made up of true portions of circles of varying diameters. Several interesting effects may be noticed. Those interested in optical illusions will find many other surprising illusions described in books to be found in their home or local libraries—*D. R. V.*



Hints *for the* Home Work-



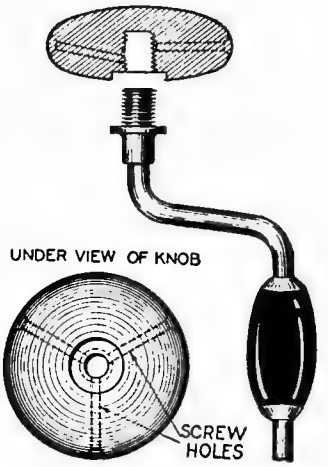
Knives made from hack saw blades. The larger knives are made from power hack saw blades.

Knives From Hack Saws

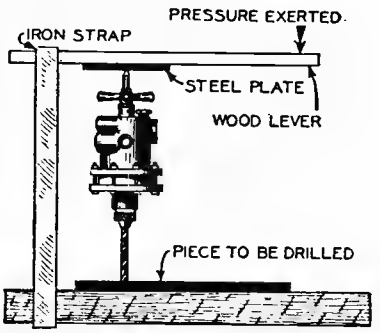
SERVICEABLE knives can be made from broken hack saw blades. The blade should be ground down to the particular style desired on an emery wheel. Care should be taken not to allow the blade to become too hot when grinding. Keep the blade cool by dipping into water while being ground. After grinding, fine emery powder and water will remove any dulness, and the rough scratches of the emery wheel if these marks are objectionable.

Good handles for these knives can be made from leather or wood. The steel should be softened at the handle part in order to permit holes to be drilled for the handle. This is done by heating that part to redness and allowing it to cool very slowly.—*R. B. Wailes.*

Repairing the Brace



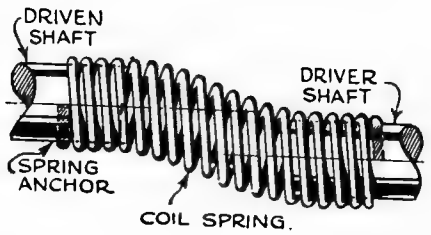
A CARPENTER'S brace with a loose knob may be repaired as shown. Drill 3/16" holes for ¼" stove bolts and countersink for the heads of the bolts. File the ends of the bolts to a point so that they will fit the thread after the knob is in place. Stagger the holes, one a little higher than the other to permit each bolt to catch a different thread. After the holes are drilled, screw in the bolts until they just show through, then screw on the knob. The whole may then be tightened by screwing the bolts in tighter. Many a carpenter's brace has been discarded after a long and hard usage. This arrangement will permit these tools to be resurrected and again put into service. Braces fixed in this way have been known to serve their owners for many useful years.—*A. P. Kelly.*



Handy Portable Motor Lever

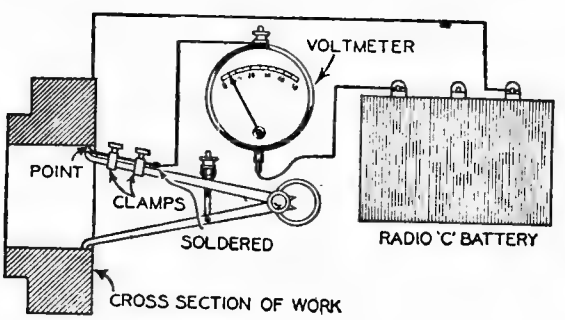
IN order to bring sufficient pressure upon a portable drill for rapid work an improvised pressure lever may be devised. The lever shown was made from a steel strap 1½ × ¾". It was bent over a strong wooden lever, and bolted to the same. One end of the strap was curved to fit over the bottom flange of the channel iron, while the other was made to fit the top one. A steel plate was bolted to the under side of the wooden lever to hold the pivot of the motor. This arrangement will be found useful whenever it is impractical to do the work at a drill press.—*J. Coyle.*

Flexible Shafts for Working Models

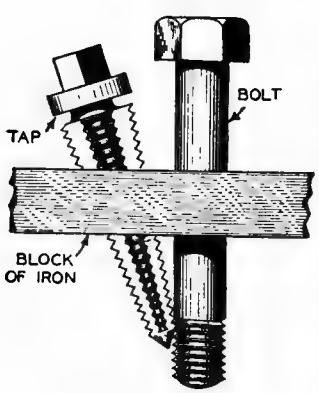


A SHORT length of steel spring makes excellent flexible shafting for model machinery. It can often be used to advantage in the place of belting and gearing. An ordinary screen door spring can often be employed. The two regular sizes fit tightly on 3/16" and ¼" solid shafts, the diameters most common on small motors and machines. The spring is simply forced onto the end of the shaft with a twisting motion. In making turns, a radius of about six to eight times the shaft diameter is most satisfactory, usually, and runs without twisting and kinking.—*R. Le Compte.*

Sensitive Calipers



A SIMPLE arrangement for making a pair of calipers sensitive for precise measurements is shown above. The contact point should be insulated from the leg of the calipers on which it is fastened.—*E. J. Pratt.*

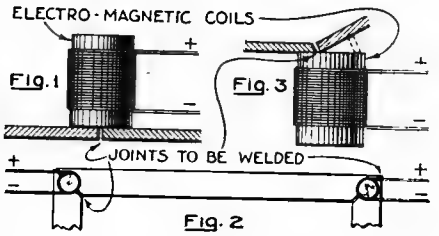


Cutting a Left-Hand Thread Without a Lathe

A LEFT-HAND thread can readily be cut without a lathe by drilling two holes in a block of iron the same size as the bolt to be threaded. One of the holes should be drilled slanted to enable the tap to cut on the bolt. The thread is cut on the bolt by turning to the left.—*J. Grand.*

Welding Aid

PIECES of iron may be held in place for welding by using electromagnets. The parts are spot-welded first, and the welding is completed after the magnets are removed.



Shop

Small Portable Grinder

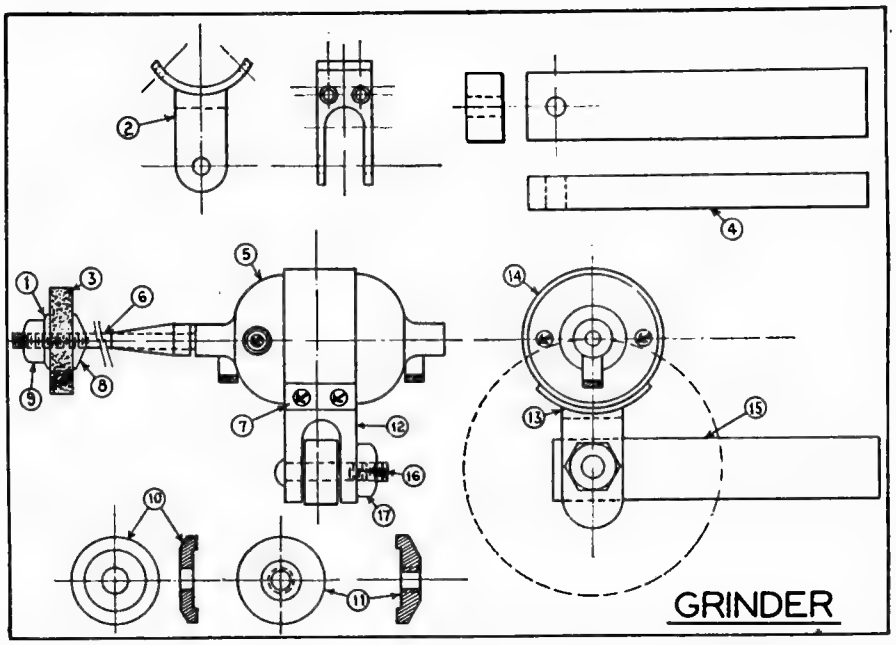
First Prize $10.00

A SMALL grinder that has many uses around the shop and for the home mechanic can be easily constructed for less than three dollars, exclusive of the motor. This grinder is handy for grinding small bushings, cylinders, pins and lathe centers. It can also be fastened in a vise and used to sharpen knives, tools and drills.

There are two pieces to be made to attach to the motor. Figures 4 and 15 show the support which is held fast by the tool post and vise. This should be made of good material such as tool steel. The saddle is shown in figures 2, 12 and 13. It is attached, as shown, to the motor. At figures 16 and 17 is the adjusting bolt for the saddle and arm. The shaft on the motor shown in figure 6 has a thread cut as shown. The side collars at 10 and 11 are made according to the size of the wheel to be used. Collar 11 is threaded and attached as at figure 8. Collar 10 is not threaded. (See 1.) The nut to hold the wheel tight is shown at 9.

A wheel about two inches in diameter works best on a small grinder of this type.

Almost every shop has a small motor suitable for a grinder of this type. Here is a chance to make good use of it.—*E. McDonald.*



Constructional details of the grinder. The dimensions depend on the size of the motor.

Doing a Large Job on a Small Lathe

WHEN a piece of work has to be done that is too large for the lathe at hand, it is a good idea to have some means by which the work may be done without sending it out to a shop with larger equipment. It is possible to rig up the small lathe so that the job may be turned on it.

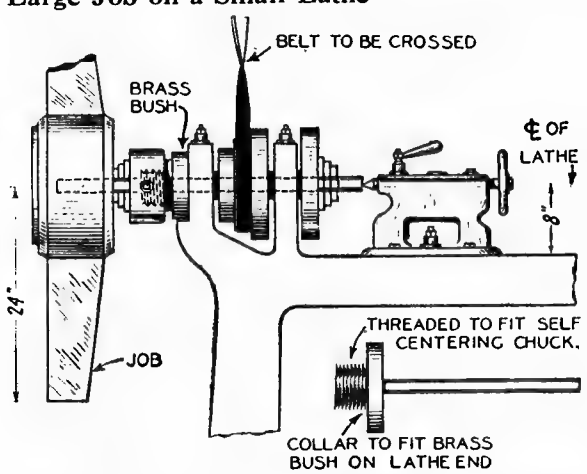
First a spindle is turned to fit through the hollow lathe mandrel. It is threaded at one end to take the chuck. A collar is made to fit the brass bushing at the lathe end. The spindle is then put through the lathe mandrel and the plain end is gripped in the chuck. The back head is brought up to the centre in the spindle end to take the weight and to prevent chatter.

A chuck is then screwed on the spindle end at the back of the lathe, and the job, which is previously drilled and pressed on to a mandrel, is placed in the chuck.

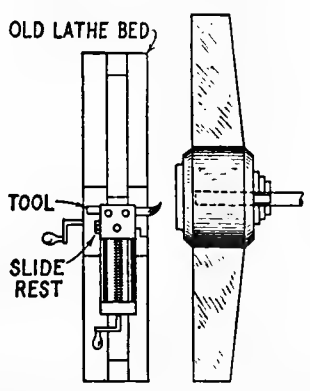
An old piece of the bed of an old lathe is then placed across the end of the lathe with the lathe rest attached. The job is then turned as far as the limit of the rest. The rest is then moved further along the bed.

In order to make the head turn in the proper direction, where no reversing arrangement is on the lathe, the belt is crossed. The head will then turn in the opposite direction.

This arrangement will be found to be useful for the occasional large piece of work and will obviate the necessity of buying a larger lathe.—*W. H. Conley.*



The spindle and its arrangement in the lathe, showing how the large piece of work is fastened to the head.



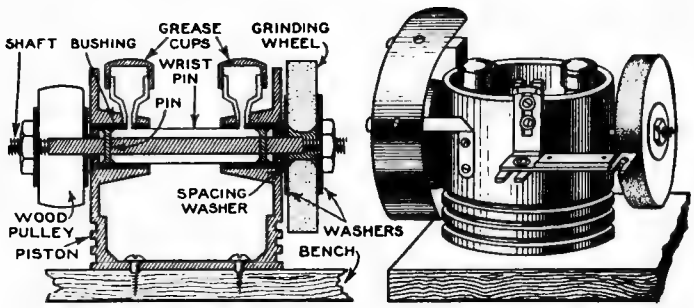
An old lathe bed is fastened to the end of the lathe and the tool rest run on it.

Hole Boring Kink

TO eliminate splitting when boring holes near the end of a piece of wood, bore the hole through work first and then saw to the right length.—*R. Wailes.*

Bench Grinder Made From Auto Piston

A USEFUL bench grinder may be made from a discarded auto piston as shown. A snug-fitting rod or bolt is inserted in the wrist-pin. The shaft is kept from turning in the wrist-pin by grinding notches in the ends of the pin and inserting rivets in holes drilled through the shaft.—*E. Thaddeus.*

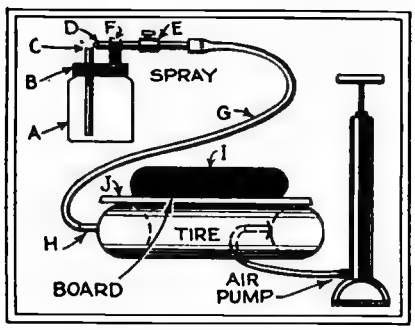


Useful bench grinder made from old piston.

WRINKLES

For Those Who "Roll Their Own"

THE small spring from an old tire valve core worked over the band around the usual book of cigarette papers makes it easier to slip off the band.—*F. Bentley, Jr.*



Paint Spray Outfit

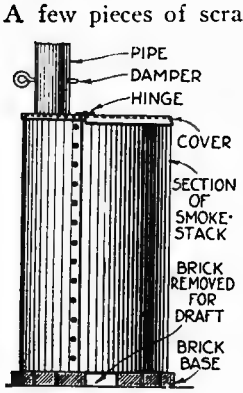
A HANDY paint spray outfit may be quickly constructed as shown. I is a weight which maintains a constant pressure in the inner tube so that even spraying results.—*F. H. Carlberg.*

Improvised Handle

AN emergency handle for a cover or door can be made with four nails and some heavy cord or wire. A good grip results.—*F. Bentley, Jr.*

A Shop Stove

THIS stove is constructed of a four-foot section of a steel smokestack. A few pieces of scrap lumber dropped into a stove like this will keep the shop warm for half a day. Draft is regulated by a damper in the pipe and by replacing a brick in the base. The stove should not be placed on a wooden floor without proper insulation. — *A. Wilson.*



Simple Method for Making Celluloid Cement

In proportional amounts dissolve 5 square inches of sheet celluloid in about ½ oz. of lacquer or Duco thinner. For best results this mixture should be in a tightly corked bottle and in a warm place. This will make a syrup-like solution, which can be diluted by adding more thinner or made thicker by evaporation.

Celluloid drafting triangles and celluloid-edged scales and rulers often get chipped or cracked, making them useless. These can be repaired nicely, as shown in drawings previously. A thick solution, as described above, is used.

Celluloid clock cases, celluloid finished articles, auto side curtains can be repaired by using a thick solution of collodion, and watch crystals which have become loose may be secured in place by using this solution like glue. The SCIENCE AND INVENTION Reporter Card may be made more durable by mounting it between two sheets of celluloid and using the thick solution as an adhesive. The small ruler printed on page 1122 of the April issue of this magazine may also be made serviceable by mounting in the same manner.

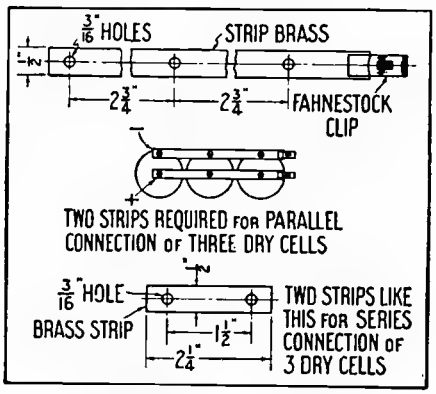
A light, clear solution of celluloid can be made into a beautiful transparent paint by adding colored *liquid* clothing dye, which can be bought in most department stores. By varying the amounts of dye and mixing the colors almost any color or shade can be obtained. This paint is very desirable for painting on glass, coloring lantern slides and films, decorating lamp shades, coloring plain electric light bulbs and for coloring drawings where certain details are to remain visible.

By spraying charcoal or pencil sketches with a light solution of clear celluloid the lines will remain fixed and will not smear nor affect the appearance of the drawing. By using a thicker solution sketches, paintings, etc., may be made glossy and waterproof.

Another service to which this formula may be put is as an *anti-blot*. A fairly thin solution is poured or sprayed over an erasure on a drawing and allowed to dry after all surplus has been wiped off. Corrections can be made over the treated spot without fear of the ink blotting or running. Porous paper and even blotting paper may be drawn on after treating with this solution.—*Contributed by E. R. Vass.*

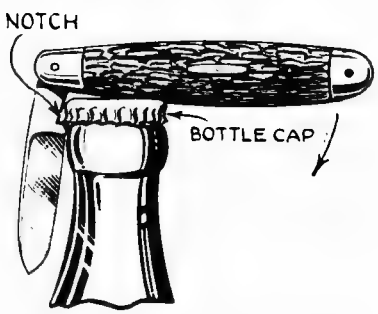
Supports for Lamp Cord

Small brass hooks screwed in the baseboard near the top and spaced every 2 to 3 ft. make a neat and convenient means for holding the flexible wire from that floor lamp. Tying the wire to the hooks with thread or string to match the color of the insulation also adds to the appearance. Pull the wire taut before tying.—*Edmund Mills.*



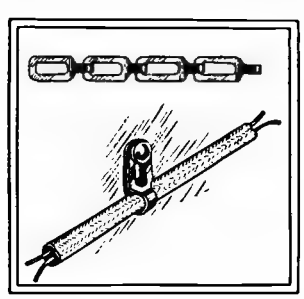
Quick Battery Connectors

FOR the electrical experimenter or worker a quick method of hooking up dry cells in either series or parallel is a labor-saving device. It can also be used permanently and will be found handy and neat.—*L. B. Robbins.*



Handy Bottle-Cap Lifter

A COMMON pocket knife may be made into a convenient bottle-top lifter by filing a small notch in the heel of the blade. This increases the serviceability of your knife and does not interfere with its ordinary use.—*V. Johnson.*

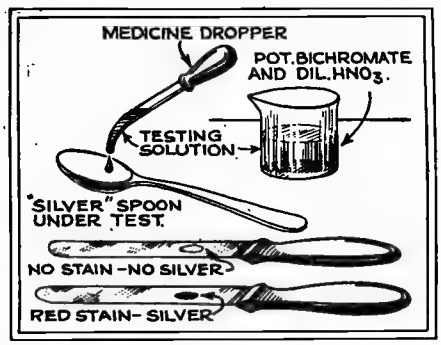


Substitute "U" Tack

WHEN it is necessary to fasten insulated battery wires, common brass safety chain can well be used. Open the link and close it with round portion over the wire. Drive a tack through the two rectangular holes, closing the link snugly over the wire and fastening it down.

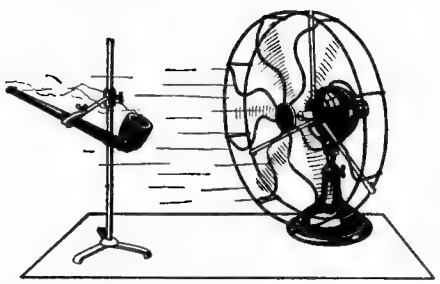
This makes a cheap and attractive fastener that will not rust. It is easier to install wiring with this method than with the regular "U" tacks.—*F. Bentley, Jr.*

and RECIPES



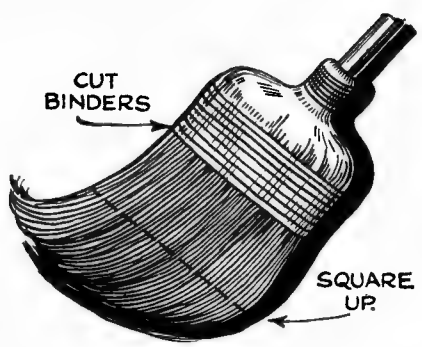
Is Your Silver Real?

YOU may test your silver plate and solid silver for purity by applying a small drop of a solution of Potassium Bichromate in dilute Nitric Acid, whereupon real silver, whether plate or solid, will give a red stain of silver chromate. Be sure to wash off the solution immediately. The mixture is made from a saturated solution of Bichromate with one-half its volume of concentrated Nitric Acid added.—*D. Harris.*



"Breaking In" Your Pipe

GENTLEMEN pipe smokers, here is a way to avoid that varnish taste of a new pipe. The pipe is filled, lighted, and placed before an electric fan. If you have no electric fan handy, try putting in a draft like that from a window. In about fifteen or twenty minutes you can clean out the pipe and refill it.—*E. Moen.*



A New Broom

BROOMS wear down unevenly, making their life short. When the splints wear down so short that it is difficult to sweep, it is a good idea to cut out some of the binders, increasing the effective length of the splints. The bottom should be squared.—*J. Ketchpel.*

Good Service from Safety Razor Blades

A man who always has a smooth, clean shave gave us some tips he has learned about the care of a safety razor. And incidentally he gets double and even more than double service out of his blades. Cleanliness to prevent rust and very hot water is the secret of his success!

He always uses hot water on the blade when through shaving, and while shaving, as it dries the razor quickly and thoroughly, leaving no moisture to make rust and a dull edge. After a shave, he removes the blade and washes the holder in hot water too, drying carefully before putting the blade back.

After the blade is thoroughly washed under a stream of hot water, he wipes it with a rough towel, toward the edge of the blade, thus using the towel as a sort of strop. Simple, it seems, but very effective as experience has shown.—*T. B. Brownfield.*

Cutting String Beans

Much time will be saved in cutting up string beans by grouping a number of them in one hand, placing them on the bread board and slicing them simultaneously.—*Contributed by Edmund Mills.*

A Simple Ink

An excellent ink is made by dissolving the lead from a copying pencil in a cup of water. This pencil can be distinguished from other pencils by the word "copying" on it.—*S. J. Weicher.*

Simple Rheostat

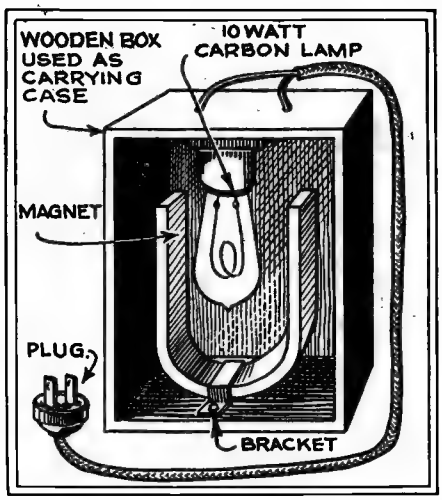
An idea that will probably prove useful to many readers is to use a "Dim-A-Lite" current-reducing socket to control a motor, transformer, etc. The socket comes with a chain switch and really works well. There are about 4 steps of voltage and for a cheap power rheostat is hard to beat.—*Simon Cherry.*

An Acid Test for Steel and Iron

File, or grind, the pieces to be tested and polish them smooth, then place them in a dilute nitric or sulphuric acid solution for a day. Wash and dry the pieces, and if they are of the best steel, the surface will have a frosty appearance. Ordinary steel will have a honeycomb surface, and iron will present a fibrous structure running parallel to the direction in which the metal was worked.—*August Jeffers.*

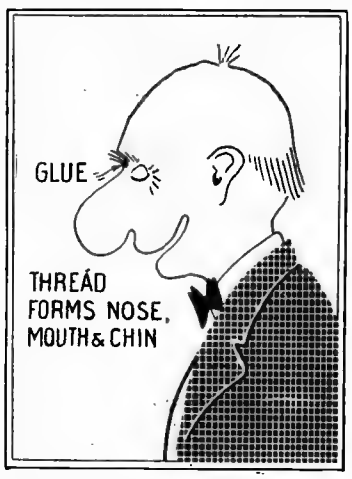
Mending Rip in Cloth

Here is an excellent method of mending a cut or tear in clothing: Take a piece of adhesive plaster and cut it to the right size. Apply it to the left side of the cloth where it is damaged, and press firmly with the fingers. The cloth should be on a smooth surface while the plaster is applied. The rip will be practically invisible.—*Frank Schmulowitz.*



Alternating Current Indicator

A TEN-WATT carbon lamp and a permanent magnet make a good alternating current indicator. When the current is on, if the filament vibrates, the current is alternating. On direct current the filament simply bends to one side.—*F. A. Ferri.*



Impersonator Cards

A CARD fixed up like the one above will afford lots of fun for the evening party. Many funny faces can be made with the cord.—*D. R. Van Horn.*

An Automatic Pipette

THE pipette is filled by suction until the liquid overflows into D. The rubber tubing is then compressed when it will be observed that the level of the liquid falls somewhat below the graduation mark. When the mouthpiece is closed with the forefinger in the usual manner, the liquid rises again and overflows once more. The pipette now held by the mouthpiece only is raised out of the liquid and the contents delivered into the receiving vessel. When trap D is filled, rubber tubing and mouthpiece are removed and the liquid is poured out. Thus the pipette works automatically.—*F. Piontkowski.*

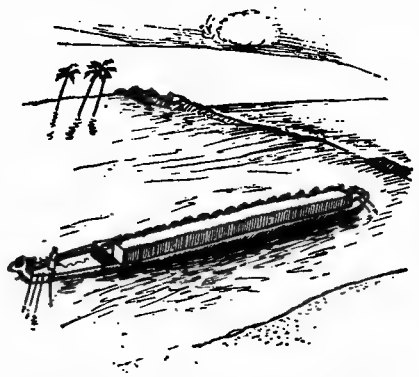
Readers' Opinions and Comments Will Be Welcomed by the Editors

What Our

How the Pyramids Were Built

Editor, SCIENCE AND INVENTION:

Reading the May issue of your magazine, you ran an article by J. H. Kraus, on "Ancient Versus Modern Wonders," on pages 20, 21-22, 23, 84 and 85 inclusive. The article on the "Pyramids of Gishe" and how built interested me most. Here is my conception.



Were the stones for the pyramids brought to their present location by ships and dumped over the sides?

It was more of a navigation feat than an engineering feat. It also may be borne in mind that the pyramids are built at the mouth of the River Nile, on one side of the bank. Since the Nile River overflowed its banks annually, it left a vast amount of detritus near its mouth.

The engineers let the detritus, mud and sand, pile up against some barriers, or sand dunes, provided for this.

After the waters receded, the mud was collected and built up in the shape of a circle, forming a dam.

The torrid sun baked the mud and sand, and formed a strong wall like masonry.

The inside of this vast circle was then fitted with special holes to take in water. The second year the river again overflowed and deposited more mud and driftwood against this huge dam. After the waters again receded, the work was begun. Box-like boats were filled with water to the sinking point, then were drifted or towed near this huge circular dam. Fitted against the holes provided for this, they filled it to its first stage by emptying the contents of the boats on the outside. Then the many boats inside this vast circular dam were raised to a certain stage, in much the same principle as our own Panama Canal. Now these boats contained numerous blocks of stone for the pyramids. The stones were rolled overboard into their position. Then another stage, some more water was let in by boats on the outside, raising the boats on the inside; then the second stage. Stone rolled overboard into position, same as before.

This continued until the pyramids were built, all in a short time, two years. Not much man power, or time, but a clever way of harnessing the river, the wind, leverage, and navigation.

As the pyramids were "sunk" into place, before the next annual flood, the water was let out slowly, so as to wash away the entire circular dam, letting the many empty boats on the inside flow out and into midstream of the River Nile. The next annual flood (third year), practically all the remains of the once huge circular dam were washed away, leaving the pyramids standing.

This is a logical conception, not touching much on engineering, but on irrigation and navigation, and not entailing much mechanics, or machinery.

The bigger question is not how the pyramids were built, but how the huge stones were quarried up state and cut. Let's have your opinion.

P. HILLBERG,
Cincinnati, Ohio.

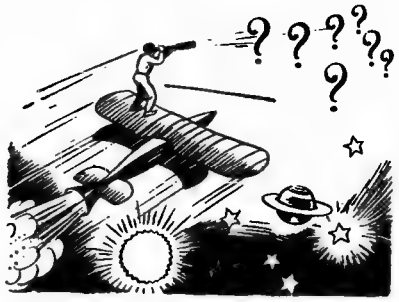
(Assuming that what you claim is correct, how do you account for the mathematical position by which the interior of the pyramids was laid out? It is quite evident that if stones were dropped overboard, they could not produce the passage and room found in the pyramid. It is scarcely likely that these rooms were built up after a solid wall of stone had been put in place. If enough man-power were present to build the pyramids, it is quite likely that that same man-power was able to quarry the stones.

The cutting of those stones is a difficult question to decide upon. Perhaps they were chopped up in huge blocks and dragged along the surface of other rough stones which smoothed them down. Of course, this is all conjecture and your guess might be equally as good as ours.—EDITOR.)

Space, Time and Relativity

Editor, SCIENCE AND INVENTION:

In your issue of SCIENCE AND INVENTION for April of this year, under the heading, "Space, Time and Relativity," by Dr. Menzel, page 1199, appeared the following: "Einstein, however, says 'no'; the ninety-sixth circle would be the last one that can be drawn in our universe; . . . after five hundred billion years, we should return to our starting point. The universe is, therefore, finite."



What will one see if he gets to the very end of Einstein's limit of space and looks into the distance beyond?

Now, while granting that Dr. Menzel is correct, and also that Einstein's theory may be correct, I would much appreciate it if you could enlighten me—briefly—as to how Einstein arrives at such a supposition, and also as "the universe" evidently includes all space, what does Einstein suppose to be without this "ninety-sixth circle."

While I am quite prepared to believe that, "by no possible method can we distinguish between the arc of one of these huge circles and our ideal straight line," and also that it may not be possible for us to travel (theoretically) in any straighter line than along this arc; I quite fail to see how this is any argument that there is nothing without this circle, and anyhow, if that were so, how far does nothing extend?

Am afraid that this letter will be rather belated in reaching you, but hope to see an answer in your publication a couple of months hence.

Have been a reader of SCIENCE AND INVENTION for about two years now and consider it an excellent publication for furthering one's general scientific education.

D. A. ROBINSON,
Warburton, Victoria, Australia.

(Perhaps some of our reader supporters of Einstein's theory will give us some information regarding what is beyond space.

We merely cite Einstein. We do not profess to agree with him or his theory in its entirety.—Editor.)

Insect Cradle Builders

Editor, SCIENCE AND INVENTION:

"Insect Cradle Builders" by Dr. Ernest Bade most interesting—eagerly awaiting more such articles.

A. H. BISS,
Monte Carlo.

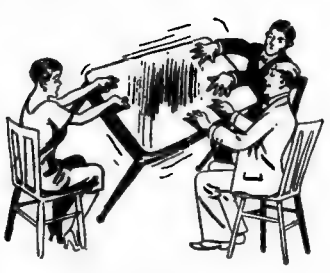
(Thank you and we will try to have Dr. Bade give us more articles on similar subjects.—EDITOR.)

Spiritism

Editor, SCIENCE AND INVENTION:

I was reading an article in an Indianapolis paper to the effect that your concern was offering a prize of some $23,000 to anyone who can prove that Spiritism or Spiritualism or Clairaudient Phenomena or the like supernatural phenomena were actual facts. I have not the article at hand and do not remember the exact wording but I remember that a certain man attempted to give an exhibition of this sort of thing and failed to win the prize, that he commanded a table to come to him and it refused to do so, so goes the article. I don't suppose any man living can make inanimate objects walk from place to place.

What is required in order to win this prize that you offer? I am not any sort of a spiritualist or dabbler in this sort of thing. I am an engineer and draftsman,



The table did not move toward the spiritualist, but merely rocked up and down, in an attempt to answer questions.

Readers Think

Questions and Discussions of General Scientific Interest

and am interested in invention and patents and patent practice, and also in home building. I don't call myself a scientist but I am interested in scientific matters, which you are also or you would not be investigating this subject.

L. L. MEAD, Carlinville, Ill.

(The newspaper clipping which you read probably garbled the facts considerably. SCIENCE AND INVENTION magazine has a prize contest of $21,000 for genuine spirit manifestations of any nature. Prize conditions for this award have been repeatedly published in SCIENCE AND INVENTION magazine, and are also found in the introduction to the book "Spirit Exposés."

The man that appeared as a contestant for this prize recently, did not cause a table to move. After four men were seated at the table, the table was tipped and then was made to rap signals on the floor, indicating by the number of raps the letter in the alphabet to which it apparently referred. Actually, the effect is purely subconscious, but believers in spiritualism do not hold the same viewpoint which we hold. Results were void.—EDITOR.)

Handwriting Reveals Character?

Editor, SCIENCE AND INVENTION:

I have been a reader of the SCIENCE AND INVENTION for years but I have never seen such "stuff" as this before.

What's the Grand Idea???

On page 1215 of the SCIENCE AND INVENTION for April 1929 you may read the following:

"YOUR HANDWRITING indicates your character."

Now I doubt very much if anyone's handwriting "indicates" their character, or ever will. This person gives you a "sample reading" for the small sum of twelve cents. But I doubt if it is worth so much.

Just below this "ad-let" another reads:

"LET ME READ YOUR CHARACTER." Send birth date and twelve cents."

They must have their conventional 12 cents first.

I wonder what makes them think that HANDWRITING indicates a person's character.

I also wonder why you must send your Birth Date to the sponsor of "ad-let" in number two.

On page 1214 of the same issue I read the following:

Objectionable or *misleading* advertisements not accepted.

Can a handwriting expert actually reveal one's character? The answer of the editor is an emphatic "no."

Now exactly what does this mean?

All this puzzles me because on page 1140 of SCIENCE AND INVENTION, April 1928, I read this:

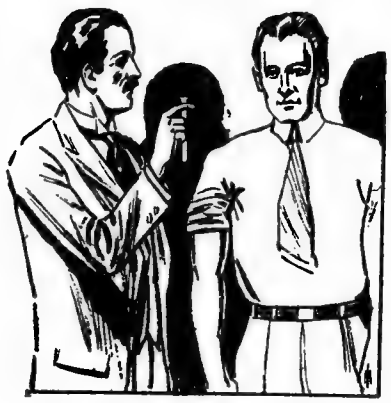
"We do not believe in graphology." Etc. . . .

The comment ends with this statement by the editor. . . . "No, there is nothing in graphology." Did the editor mean that???

Cordially yours,
R. W. R.
Hollywood, California.

(The editor certainly did and still does imply that there is nothing in graphology! We do not think that you will find these same "ads" now appearing.—Editor.)

A Trusted Test



Does the Wasserman test actually tell the quality of the blood? For what other diseases is it specific besides the one well known?

Editor, SCIENCE AND INVENTION:

I read an article in the May issue of (a leading popular science magazine, name deleted by the editor), which stated that a man by the name of Kane gave forty-two quarts of blood to save eighty-six lives. The article stated that Kane's blood was of extraordinarily high quality. "High in the 'Wasserman Test' by which physicians gauge the value of blood."

I was always under the impression that the Wasserman test is used for indicating the presence of syphilis. Please explain.

JOHN BERTHOLD,
Philadelphia, Pa.

(The Wasserman test is a specific (opinions differ as to whether it is truly specific or quasi specific) for syphilis, and Frambesia commonly known as the yaws, a contagious disease of the skin, occurring in the hot regions and generally marked by raspberry-like excrescences on the hands, face, feet, etc. It is caused by a micro-organism known as *Treponema pertenue.*

Positive reactions also occur in scarlet fever, malaria, etc., but these reactions are atypical, and not to be confused with the typical reaction of syphilis.

The important reaction in blood transfusion is to find whether or not the donor's blood is compatible or incompatible with that of the recipient. Human beings can always be divided into any one of four groups, depending upon the agglutinins present in the serum and the way in which the cells agglutinate (clump together). The article evidently had reference to this agglutination test.—EDITOR.)

Must Have College

A college education is certainly worth while, says this writer, who deplores the fact that she didn't get one.

Editor, SCIENCE AND INVENTION:

Should the task be imposed upon your child to saw a huge limb off a tree would you hand that child a saw with dulled and broken teeth? Would you say—"If he has perseverance he will get it off no matter what the handicap." Perhaps that is true if he has the perseverance and the mettle in him he will. However, the task would be enough with good tools, perhaps a cross cut saw and a fellow on the other end of the saw to help.

A boy or girl now-a-days is like the child with the old saw if he or she has no college education. I know and I know from experience. I am a High School graduate and had one year of college at Indiana University. That has counted but it is not enough.

Last year my husband, who is an Electrical Engineer, suddenly lost his position as Superintendent of our Municipal Light and Water plant. We have five children, we are paying on our home—it became necessary that I help to tide us over.

What could I do? I canvassed the situation—I could not teach because I did not have a college education. Although I have taught everything from phonics up to Latin, French and Algebra for the past sixteen years, that did not entitle me to go into a school room and thereby earn even a fair salary.

I turned toward Librarian work—there again I was faced with certain college requirements. It is true I have written a few articles and a bit of poetry for our state paper and they were printed, but I lacked the technique they give you in college and so that door reverberated as I turned on to the next on my list.

In the *Indianapolis Star* there was an advertisement—"Wanted—a graduate of Domestic Science to take charge of and teach the making of tasty dishes."

You notice it said A GRADUATE. I have cooked for twenty years. I can do plain or fancy cooking and I can make rolls and breads and Lady Baltimore Cakes and French Dressings, etc.

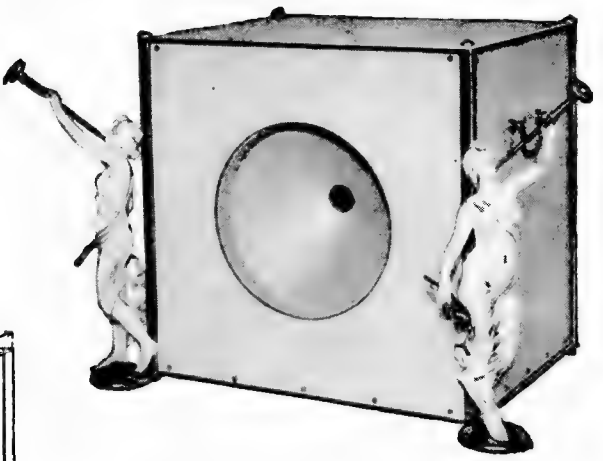
I applied to a friend who manages a Country Club for a job. You note I said a job, not a position. I told her—put me anywhere and everywhere. She has done so because we were friends and I needed a lift. Had I had a college education I could have given myself that lift.

Oh yes! I intend to succeed and even am going to try for a Country Club to

(*Continued on page* 563)

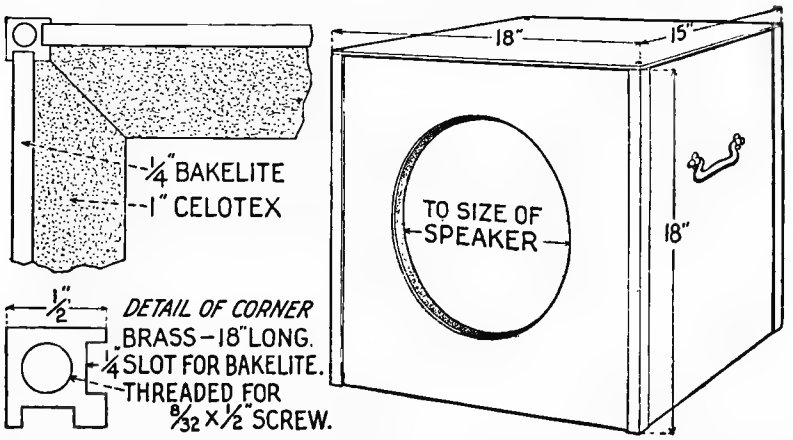
Attractive DYNAMIC SPEAKER Cabinet

By A. Brams



Showing the complete ornamental dynamic speaker.

DETAILS OF SPECIAL B.B.L. DYNAMIC SPEAKER CABINET



HERE is a dynamic speaker cabinet which combines the features of attractiveness and compactness without sacrificing efficiency or quality. It can be made up of many different materials and in different finishes. This is possible because the cabinet is lined with *celotex*, which will prevent the vibrations that go through the walls of the cabinet from reaching the back of the cone. The cabinet shown is made of bakelite, but sheet metal, light wood, celluloid or any other substance that is easily worked and gives an attractive appearance may be used. As the whole cabinet acts as a baffle-board, it is not necessary to make the front as large as usual, thus making for compactness and better proportion.

The cabinet is constructed as shown in the diagram. The back is left open, or a back piece similar to the front may be made, being sure that there is an opening about equal in area to the opening in the front. The speaker chassis is mounted inside, the mounting depending on the make of chassis used. Care should be taken to fasten together securely the parts of the cabinet so that there is no vibration between them. If ornaments, like those in the picture, are used, they should not be of the type that will vibrate and cause extraneous noises. The openings in the back and front may be attractively covered with cloth or some form of grill work.

Better results may be had with a celotex lining on the top and bottom, but that is not essential.

Soldering Iron Control for Delicate Work

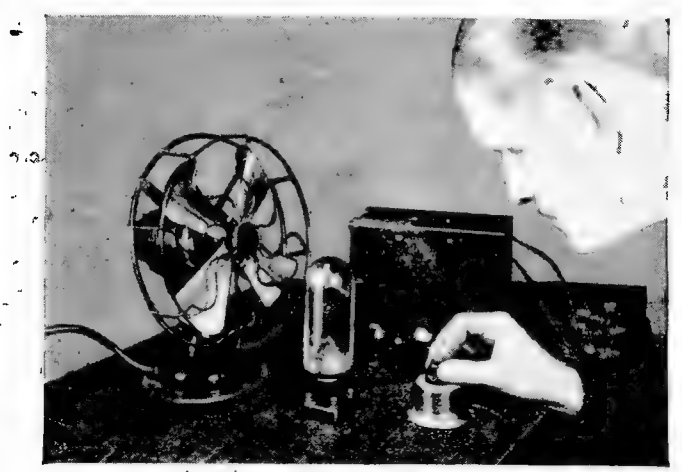
IT is not generally realized that an electric soldering iron, to be quick-heating, must operate too hot when in continuous operation. Some means of control, therefore, is desirable to prevent excessive heat and a marked shortening of life. The simplest control is an adjustable resistance in series with the electric soldering iron. For this purpose, the speed control clarostat, capable of dissipating 80 watts, yet providing a resistance range from 25 to 500 ohms, is desirable. The short-circuiting push button on the device serves to increase the heat momentarily, such as for heating, while the resistance may be set for the "idling" heat. In soldering very fine wire, such as in loud-speaker repairs and audio transformer secondaries, this heat control will be found invaluable.

The heat control mounted on the work bench.

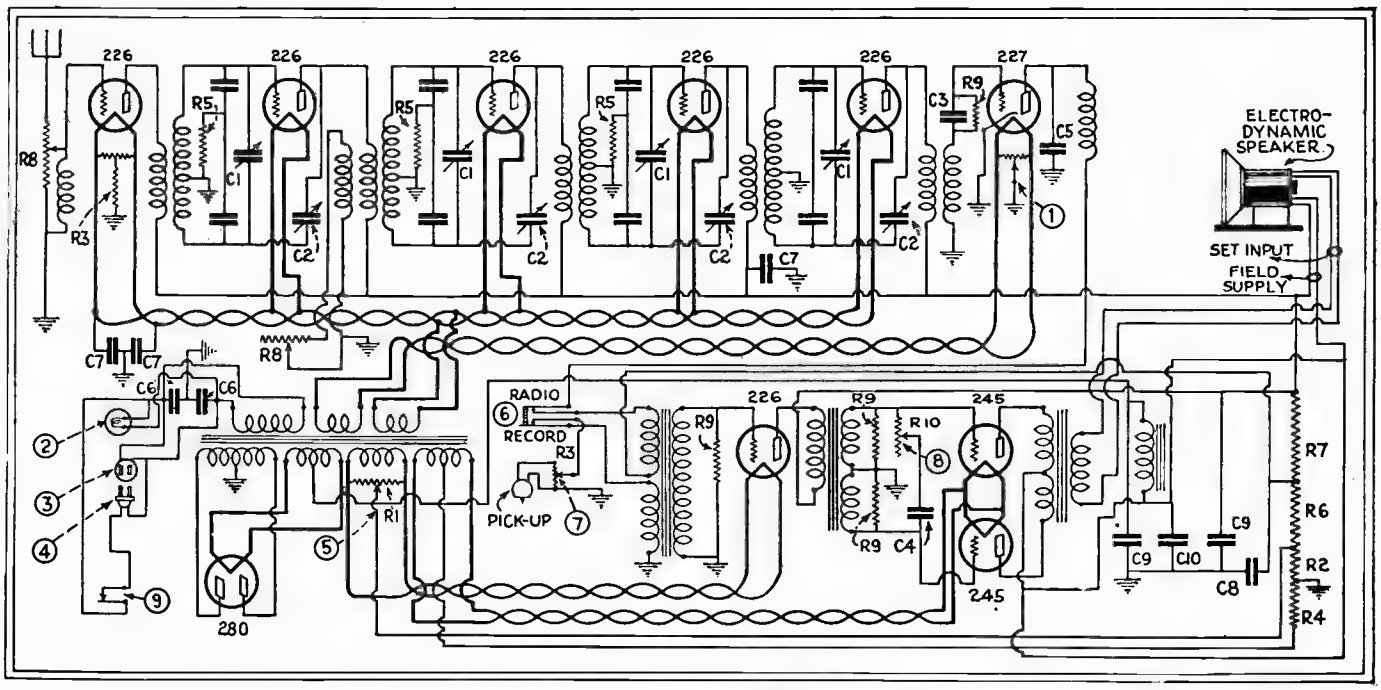
Home-Made Stroboscope to Study Moving Things

HOW would you like to study different things in motion as if they were standing still? That may be done by means of the stroboscope—a device which causes the periodic illumination or viewing of a subject, so that it may be seen at the same point in its cycle of operations, cycle after cycle.

A B-eliminator feeds a neon lamp with a continuously variable resistance, the table type clarostat in series. In operation, the resistance is adjusted so as to obtain a periodic flicker from the neon lamp, and this flicker is used to illuminate the object being studied.



Studying the whirling blades of an electric fan with the stroboscope.



Circuits of new Victor 9-tube a.c. receiver.

New Nine-Tube A. C. Receiver

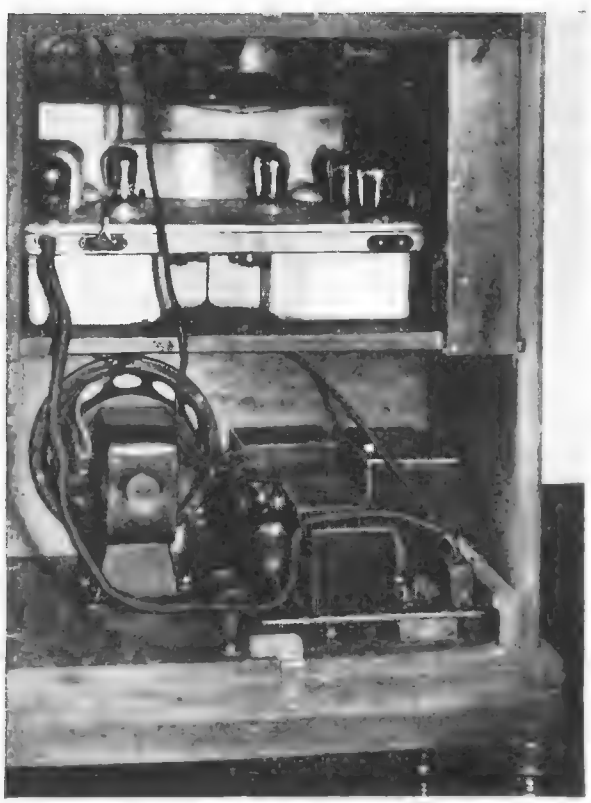
Gives Superior Tone Quality

ONE of the latest products of a well known phonograph manufacturer is a combination electric phonograph and radio receiver which is housed in a compact cabinet of burl walnut veneer and bird's-eye maple. The electric phonograph is as new as the receiver itself and records are reproduced by utilizing part of the radio system.

The radio receiver employs nine tubes and is equipped with five stages of radio frequency amplification. Two 245-power tubes are used in push-pull in the last audio stage. A 227 is used for the detector and 226 tubes in the radio frequency and first audio stages. A full wave rectifier of the 280 type is used in the power pack. A high degree of sensitivity is made possible by the use of a mechanical system of micrometer adjustments on the tuning condensers which permits automatic alignment of the tuned radio frequency stages throughout the entire broadcast spectrum. Each set of condensers is aligned at the factory and locked into position. A new method of stabilizing the radio frequency circuits permits a high degree of selectivity without causing any decrease in sensitivity.

Tuning is accomplished by means of a single lever control which operates over a full vision illuminated scale accurately calibrated in kilocycles, with a space at the top for marking the station positions. Accurate vernier adjustment can be obtained by turning the knob of the lever. There are three additional controls; namely, the volume control, the radio record transfer switch and a small snap switch which controls the supply current.

At the right is a photograph of the front view of the receiver and electric phonograph showing the new tuning control.



Above is a rear view of the combination showing the receiver itself, power pack, and dynamic speaker. The combination instrument is equipped with an induction disc motor, 12-inch turn-table and straight pick-up arm.

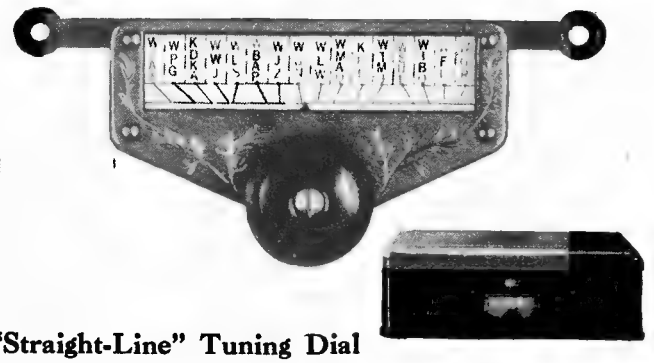
Within the set is a *harmonic modulator* which enables one to regulate the emphasis on the base according to the listener's preference or to suit the acoustic properties of the room in which the receiver is used. This modulator is set at the factory for the best reproduction over the entire musical scale. The amplifier unit is placed below the set with the dynamic speaker. Specially treated and metallized cloth is used for the cone (*Continued on page* 562)

New Radio Devices

De Vry combination radio-phonograph and talking movie cabinet, showing the movie equipment. The small door at the front of this compartment opens to permit the rays of light from the projector to reach the screen.

Combination Radio-Phonograph and Talking Movie

NOW, in one cabinet, the American home may install the four entertainment inventions of the age—radio, phonograph, movie and talkie. The QRS-De Vry Corporation has recently put on the market such a combination. The combination includes the latest model De Vry 16 mm. motion-picture projector, which is connected to the adjoining phonograph turn-table mechanism by a synchronizing shaft. The radio is an 8-9 tube a.c. set, using screen-grid tubes.



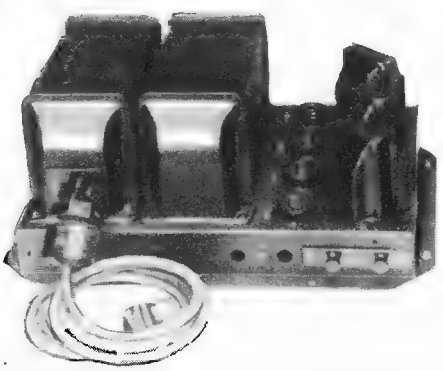
"Straight-Line" Tuning Dial

THE Master Engineering Company, Chicago, Ill., announces the Master Tuning Selector, which is intended to replace the regular tuning knob on the set. The indicator travels in a straight line instead of a circle.

Device to Regulate Voltage

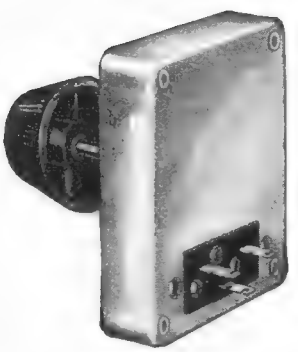
THE new Amperite self-adjusting line control regulator is a recently perfected device constructed in a glass-bulb form which is remarkable for its regulating efficiency. It is useful for a.c. receivers and acts as an insurance against burning out expensive tubes.

Well-Designed Audio Amplifier



A NEW audio amplifier, called the PAM, recently put on the market, will supply power enough to fill large halls and auditoriums with sound waves. This amplifier may be used to amplify radio signals after they are received for reproduction of phonograph records and for public address systems. The unit is completely self-contained. It plugs into the 110-volt a.c. lighting circuit. Four tubes are used and they are one 227, one 281 and two 245's. It operates directly into a loud speaker; it is built by Samson Electric Co., Canton, Mass.

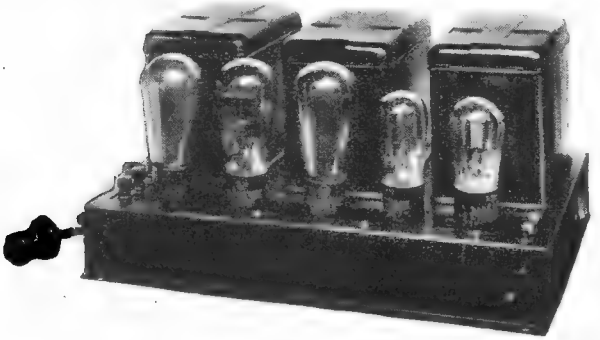
Super Volume Control



THE new volume control, called Super TONATROL, manufactured by Electrad, Inc., New York City, is a long-life control especially designed for high voltages. It easily dissipates 5 watts without breaking down or varying in value. The resistance element is fused to an enameled metal base. A pure silver floating contact is used. The metal cover aids rapid heat dissipation. It has many applications.

A New Push-Pull Power Amplifier

THE latest device of the Radio Receptor Company, New York City, is this push-pull power amplifier, using the new 245 tubes. Push-pull amplification has many friends.



Short-Wave Converter

OF interest to the short-wave enthusiast is the new short-wave converter manufactured by the Westside Radio & Elec. Co., of Miami, Fla. The converter is designed to work with any receiver.

A Monthly Question and Answer Department Conducted with a View Toward Helping Radio Constructors and Experimenters

RADIO ORACLE

Devoted Only to Queries of General Interest

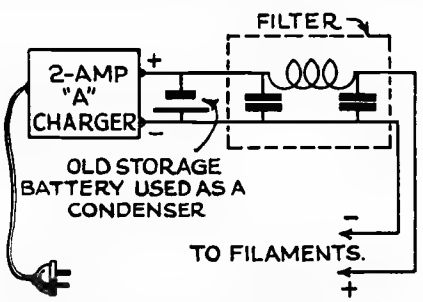
Making the A-Eliminator Work

(728) Mr. Henry Doyle, Galveston, Texas:

Q. 1. Recently I constructed an A-battery eliminator, utilizing my old two-ampere charger as a source of power and rectifier. The filter consists of a special condenser of 2,000 mfds. manufactured for that purpose, and a large A-choke. The filter did not work satisfactorily and I had to connect up the old battery to the set again. There was a bad hum and the rheostats on the set would not cut the current down enough. What can I do to eliminate the hum and cut down the current?

A. 1. Eliminators of this type are not always satisfactory, because the source of supply and rectifier are not designed for the filter. In such a case it is usual to employ a so-called brute force filter where the chokes and condensers are so large that the hum is choked out. This is the type filter you are using. The only way that you will get satisfactory results is by increasing the size of the filter.

You may use your old battery as an extra large condenser to increase the size



Connection of old storage battery as a high-capacity condenser.

of your filter. Give the battery a good charge, fill it up with distilled water, and connect it as shown in the diagram. As you are only using the battery as a condenser, and not as a source of current, it will not be necessary to charge the battery again. The internal resistance of the battery will also keep the supply voltage down to six volts so that you will have no trouble with the filaments overheating.

Although you have not eliminated the battery, you have done away with the bother of looking after the battery, for it will not be necessary to subject it to periodic chargings. It will only be necessary to add water to the electrolyte about twice a year, for practically none of the water will be lost through electrolysis.

What Farads and Henrys Are

(729) Mr. F. C. Bosset, Houston, Texas, asks:

Q. 1. Among the various and numerous technical terms used in radio are the expressions — micro-farad and micro-henry. I have referred to numerous books on these two terms and cannot seem to get a clear definition or conception of these two terms. I would be very grateful if you could explain them. Possibly you can illustrate in some way, so that these two terms may become clear to me.

A. 1. Just as the gallon, pint or gill is a unit of measurement to compare or measure liquid, and the inch, foot or yard a standard to compare or measure size or length, so the henry and farad are units of measurements to compare various sizes of coils and condensers, respectively.

The unit of capacity is the farad. How large this unit is may be somewhat vaguely suggested to our imagination by the fact that if everybody in the United States had 18 each of the so-called .0005 micro-farad condensers (usually equal to 18 plates), the total capacity of the whole lot connected in parallel would be one farad. The question naturally arises in everybody's mind why such a huge unit was chosen to begin with. A volt, the unit of potential, is a convenient size. An ampere, the unit of current, is also convenient. An ohm is an easily obtained quantity of resistance. These three are the basic units. Starting with these three, such a unit as a farad is a derived unit. That is, it follows as a matter of definition.

A condenser is fundamentally a dielectric with a conductive plate on each side of it. Connected to an electric source, the condenser is charged. The larger the charge, the greater the difference of potentials between the two conductive plates, and the equation is Q = E times C. When Q is the charge, E is the potential, and C is a constant for any particular dielectric and arrangement of parts. C is a ratio of Q to E, and we call it the capacity.

The unit of capacity is the capacity of a condenser charged to a potential of 1 volt by a unit quantity of electricity. The name of a unit quantity of electricity is a coulomb, which is the charge transmitted in one second by a current of one ampere. Really, therefore, the farad is the ratio of the unit of charge to the unit of potential.

Like the unit of capacity, the unit of inductance is a tremendous unit. It is the henry. While in capacity we usually deal with the millionth part of a farad, in inductance we usually deal with the thousandth part of a henry, the millihenry.

The henry is also a derived unit and its size is due not to design but to force of circumstances. It is the inductance in a circuit when the electromotive force induced in a circuit is one volt and the inducing current varies at the rate of one ampere per second. It, therefore, is derived from the unit of voltage and a unit of current.

Operating Radio Control Apparatus

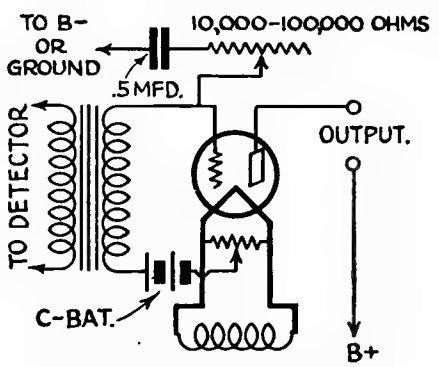
(730) Mr. D. Brown, Washington, D. C., asks:

Q. 1. In making radio control apparatus, is it necessary to use a coherer and decoherer arrangement to operate the relay? I have seen several descriptions of radio control apparatus and all of them used such an arrangement. I should think you could use a modern vacuum tube receiver, rather than the old-fashioned coherer and decoherer.

A. 1. Modern receivers with power amplifiers may be used to operate relays for controlling objects by radio. Any type of receiver that will produce an impulse clear enough to operate the relay may be used.

The reason you have always seen this apparatus connected to a coherer and decoherer receiver is that such an arrangement permits the use of an ordinary low ohmage relay. It is possible to balance this with the coherer and decoherer arrangement, which is itself of low resistance.

Vacuum tubes have a high resistance



A volume control for AC tubes which does not cause distortion.

output and it is necessary to have a high resistance relay to function properly with them. This makes the arrangement very much more expensive and complicated, for high resistance relays of this type are very delicate and costly instruments and it is necessary to arrange complicated protection apparatus for them.

A simple type coherer receiver is unreliable, except over a distance of a few feet. But it enables the experimenter to build apparatus by which he can study radio control at a price within his reach.

Volume Control for AC Tubes

(731) Mr. William Acker, Canton, Ohio:

Q. 1. How can I make a simple volume control for a set using AC tubes?

A. 1. You can make a simple volume control for your set by using a variable resistance and condenser as shown. Any condenser of half a microfarad or more may be used, and the resistance should be of the continuously variable type, and should have a resistance of from 10,000 to 100,000 ohms. Such a volume control will not affect the quality of the received signals.

Scientific Humor

A Monthly Fun Page for Those Who Enjoy a Laugh

VICE VERSA

A man saw an advertisement of a safety razor with an automatic attachment for resharpening blades. He wrote to the company—

Gentlemen:

Enclosed find check for which please send me one of your new scientific safety razors.

Very respectfully yours,
Mr.————

P. S. I forgot to enclose the check, but I presume that it will make no difference to a company of your standing.

The company replied:

Mr.————

Dear Sir:

Enclosed find your safety razor. We hope it will give you good service.

The ———— Co.

P. S. We forgot to enclose the razor, but we presume that a man with your cheek won't need one.

—*Sidney Gnann.*

A BALE FOR EVERY AVIATOR

AL—Well, at last a real use for all our old straw-piles has been discovered.

TIM — What is it?

AL—They spread them along under the airplane routes to improve the land.

—*L. S. Allen.*

BUT MAN MANAGES HER

SHE—"Woman is a great force in this world. Even a big locomotive is referred to as 'she.'"

HE—"You are right—but it's because of the noise it makes."

—*R. W. W. Williamson.*

HE'S A SAX PLAYER

PROF.—Howe, have you any organic trouble?

HOWE—No, I am not the least bit musical.

—*Miss M. M. Roger.*

First Prize—$3.00

NO MOONSHINE

CORONER—Are you sure it was midnight when you heard the two shots fired?

WITNESS—Yes, I was in the garden and noticed the time by the sun dial.

CORONER—And how could you do that in the dark?

WITNESS—I had a flashlight.

—*Leslie F. Carpenter.*

ALL jokes published here are paid for at a rate of $1.00 each; $3.00 is paid for the best joke submitted each month.

Jokes must have a scientific strain and should be original.

Write each joke on a separate sheet of paper and add your name and address to each.

Unavailable material cannot be returned.

THE CATS

I had a cat. A tortoise shell.
She died—and really dyed quite well.
She made a muff that looks like mink;
And it is curious, I think,
That though she no more care demands,
That cat is still upon my hands.

—*Grace E. Holman.*

HAS HOLE ON OTHER SIDE

"Look, you have your socks on wrong side out."

"Yes, I know. My feet were hot, so I turned the hose on them."

—*Orville Vanderlip.*

ALSO EATING HIS HAND

"Is Bill a good chemistry student?"

"Good, I should say he is. He's got the acids eating right out of his hand!"

—*Margaret Clopp.*

BUT IT DESTROYS THE CLOTH

Did you know that: Limberger cheese will remove the odor of onions. So will sulphuric acid remove ink stains from garments.—*Mason.*

TRY PRUSSIC ACID

"Have you some of that gasoline that stops knocking?"

"Yes."

"Then give my wife a glass."

—*Elizabeth Buerman.*

SAND, OF COURSE

SEA CAPTAIN —Over there is an ocean liner.

OLD LADY—My gracious, and pray tell me what they line the ocean with?

—*Leslie F. Carpenter.*

WAS SHE BLINDFOLDED?

DOCTOR—What did that flapper do when you put the thermometer in her mouth?

NURSE—She asked me if I had a match. —*Leslie F. Carpenter.*

WITHER OR NOT

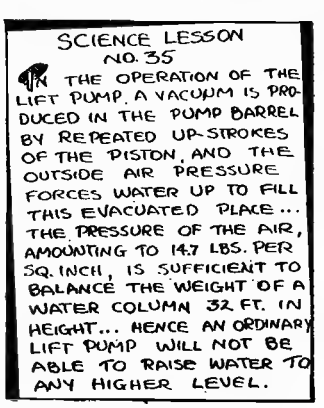
JIM—Wall flowers are usually pretty well withered.

TOM—Yes, but they are never pressed.

—*S. Williams.*

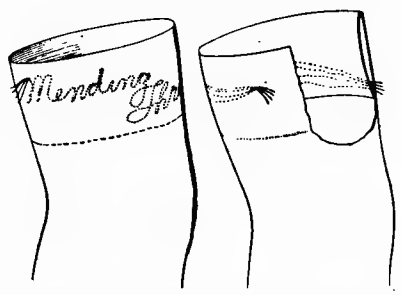
SCIENTY SIMON SCIENTIST

-- SAY JOE -- I BOUGHT THIS OLD LIFT PUMP DIRT CHEAP YESTERDAY -- IT'S JUST THE THING WE NEED TO RIG UP A WATER SUPPLY SYSTEM FOR OUR LAB UP IN THE ATTIC!
GOOD!


SCIENCE LESSON NO. 35
IN THE OPERATION OF THE LIFT PUMP, A VACUUM IS PRODUCED IN THE PUMP BARREL BY REPEATED UP-STROKES OF THE PISTON, AND THE OUTSIDE AIR PRESSURE FORCES WATER UP TO FILL THIS EVACUATED PLACE... THE PRESSURE OF THE AIR, AMOUNTING TO 14.7 LBS. PER SQ. INCH, IS SUFFICIENT TO BALANCE THE WEIGHT OF A WATER COLUMN 32 FT. IN HEIGHT... HENCE AN ORDINARY LIFT PUMP WILL NOT BE ABLE TO RAISE WATER TO ANY HIGHER LEVEL.

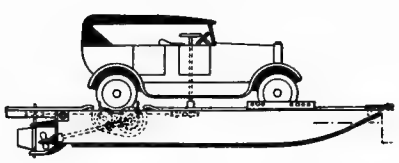
Latest Patents

Hosiery Mending Threads



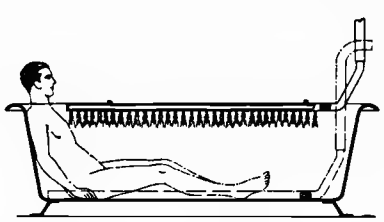
No. 1,716,007, issued to Frank Rosenthal. It is a well-known fact that stockings are subject to runs. Ladies' stockings in general are manufactured in such a wide variety of colors that it is quite impossible to get the shades of thread to correspond exactly with the color of the material of which the stocking is made, and still more difficult to secure this before the run gets beyond repair. For this reason the inventor has provided a stocking with thread which can be instantly used.

Automobile Pontoon



No. 1,715,905, issued to Alexander L. Dmitrieff. This is a pontoon of large enough size to accommodate an automobile. It is provided with a series of rollers on which the rear wheels of the auto rest and which transmits the motion of these rear wheels to the propeller. The front wheels are locked in place and the boat is steered by an auxiliary wheel coming up alongside of the usual driver's position.

Foam Bathing Apparatus



No. 1,716,109, issued to Gustav Adolf Bruggmann. This device is intended to be attached directly to a vacuum cleaner so that everyone can get a bubble bath at a minimum of expense. The tube is perforated with holes and is connected to the vacuum cleaner at the point usually occupied by the bag. The air is thus forced into the bath and it produces a froth with the soapy water.

Notice to Readers:

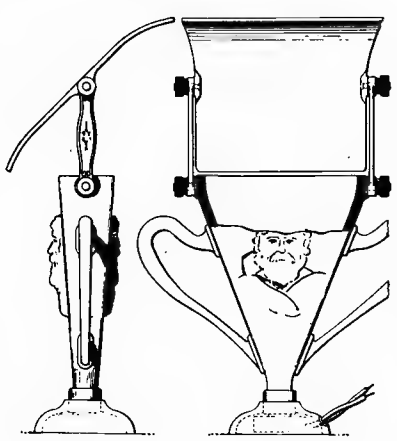
These illustrated and described devices have recently been issued patent protection but are not as yet, to our knowledge, available on the market. We regret to advise that it is impossible to supply the correct addresses of inventors of the devices to any of our readers. The only records available, and they are at the Patent Office at Washington, D. C., give only the addresses of the inventors at the time of application for a patent. Many months have elapsed since that time, and those records are necessarily inaccurate. Therefore, kindly do not request such information, as it is practically impossible to obtain up-to-date addresses.

Use for Old Cones

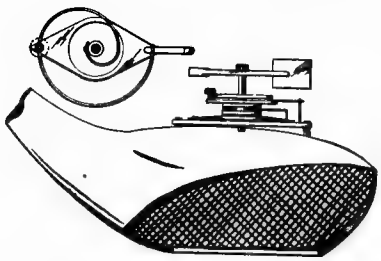
No. 1,716,215, issued to Charles K. Dunlap. In the textile industry fibre cones are manufactured in great numbers and are used in connection with knitting machines, the threads being wound on these cones. After use these cones are generally thrown away. They are sometimes sold to paper mills for reduction into pulp. The inventor has made use of these cones and he cements them together, producing a rod or a pole found particularly suitable for use as a carpet pole. The outer surface can also be ground and polished smooth and can be impregnated to make it even more durable.

New Loud Speaker

No. 1,715,886, issued to Frank M. Ashley. Here is a horn made of molded or plastic material and provided on the front with a suitable design, extending above the top as a sound reflector; this is hinged to the body of the horn and the angle can be adjusted, so that the sound will be reflected in any direction. It is claimed that the tones in such a horn are transmitted without material change in quality.

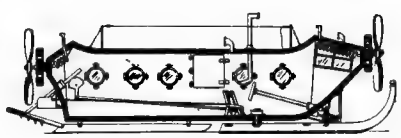


Golf Club Speed Indicator



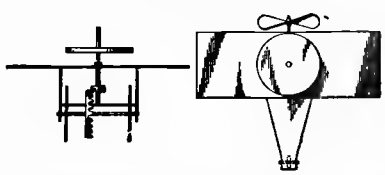
No. 1,712,537, issued to Walter P. White. Here is a device attachable directly to the golf club which is intended to help the student to improve the effectiveness of his stroke. As will be seen there is a vane mounted on the top of a golf club. This vane presents an angle with the air, except as the stroke nears its completion. At this point the vane is disposed directly across the path of the air in the room, with the result that it moves and causes a needle to register the force of that stroke. Suitable provision has been made for obtaining the greatest amount of accuracy by adjustments which can quickly and easily be taken care of.

Combination Sleigh and Boat



No. 1,716,230, issued to Clifton M. Ingram. This invention relates to a combined sleigh and boat. The device is driven by air screws and can be steered easily on either land or water. The portholes on the sides are water-tight as is the door. The body is of laminated steel construction and consequently the device lends itself admirably for both winter sport and use. A periscope is provided and the brake is intended for use on the ice only.

A Toy Airplane



No. 1,710,219, issued to Ernst Paul Lehmann. This is a gyrostatic toy, that is one in which the movement of the toy is produced by spinning a fly-wheel by hand or in any other way desired. As will be observed in the diagram, the fly-wheel couples with the wheels of the toy through the agency of gears. This causes the toy to move forward, until the force originally imparted to the fly-wheel has been expended.

A Monthly Scientific Question and Answer Page

The Oracle

The "Oracle" is for the sole benefit of all scientific students. Questions will be answered here for the benefit of all, but only matter of sufficient interest will be published. Rules under which questions will be answered:

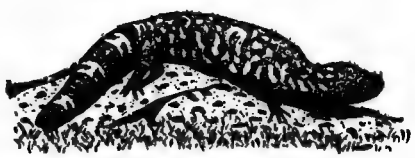
1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink; no penciled matter considered.
3. Sketches, diagrams, etc., must be on separate sheets. Questions addressed to this department cannot be answered by mail free of charge.
4. If a quick answer is desired by mail, a nominal charge of 50 cents is made for each question. If the questions entail considerable research work or intricate calculations, a special rate will be charged. Correspondents will be informed as to the fee before such questions are answered.

Is Gila Monster Poisonous

(2326) Mr. Charles D. Trone, Tampa, Fla., asks:

Q. 1. Is the lizard known as the Gila monster found in the desert regions in Arizona and New Mexico really poisonous?

A. 1. There has been some question as to whether the Gila monster is actually poisonous or not. Nevertheless, many deaths have been known to have been caused directly by this lizard. It is therefore generally conceded as being poisonous.



Here is an illustration of the Gila Monster, the bite from which often proves fatal.

Lt. Comm. C. M. Cree, R.N., retired, in "Discovery" writes an interesting synopsis of the poison apparatus of this lizard in the following way: "The poison apparatus of the Helodermis is quite unique and differs entirely from that of any of the three main types of poisonous snakes. In the Gila monsters the poison glands, which are two in number, are each formed of four lobes. These glands are situated one on each side of the base of the lower jaw instead of being either at the rear of the upper jaw or contained within the body as in the case with the venomous snakes. The means of utilizing the poison is quite different. No fangs or grooved teeth, such as are found in snakes, are present in the upper jaw of the Gila monster. Instead the poison of the animal is conducted from the glands through four ducts on each side of the lower jaw to the bases of the eight grooved teeth which are loose set in a somewhat forward position in that jaw. These teeth are grooved with canals or channels on the inside through which the venom is fed. When the reptile grips its prey it makes a grinding movement with its jaws which contracts the glands, thus forcing the poison up through the groove in its teeth and into the wound caused by the bite."

There are many cases on record where persons were bitten by the Gila monster and suffered little ill-effect. These results in all probability were due to the fact that the lizard was only able to succeed in biting with the front teeth, and was not able to enter the grooved teeth in the wound and inject the venom. The writer concludes that quite different stories would have been told had the Gila monsters managed to utilize even a small quantity of the venom.

Running from a Tornado!

(2327) Mr. Thomas J. Alden, New London, Conn., asks:

Q. 1. Is it not possible for a person to get out of the path of a tornado when he or she sees the tornado approaching?

A. 1. Much depends on the tornado. Not only is the size important but the speed at which the tornado travels and where the person will be at approximately the time the tornado reaches him.

According to the Monthly Weather Review, eight tornados were reported in the northeastern portion of Arkansas during the afternoon and the early portion of the night of April 10th. One of these tornados covered a path 1,000 feet wide and 18 miles long. It moved at such rapidity that it was reported at three towns along the line of its travel at the same time. It was only four minutes from the time it was first seen until it was entirely gone. Thus, the 18 miles were covered in the time of four minutes.

One can run away from a tornado, if one runs in the right direction and the path of the storm is not too wide or rapid.

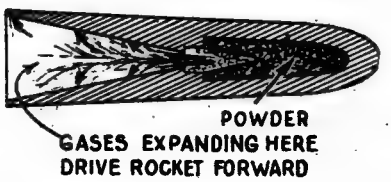
If the individual in the path of the storm ran along the lines of the storm and in the general direction in which it was traveling, the individual would then have to run at a speed of 4½ miles a minute. Of the twenty-three tornados in Arkansas during the month of April 1929, one had a path of 3,500 feet wide and 65 miles long. A much milder storm had a short path not over a mile in length and only 225 feet wide. One could probably get away from this, but then such small ones rarely do much damage.

The Moon Rocket

(2328) Mr. J. A. Sturgeon, Los Angeles, Calif., asks:

Q. 1. How is it possible for the Goddard rocket to reach the moon when there is no air against which the exploding gases of this rocket can react?

A. 1. There seems to be a general mistaken impression that the gases exuding from the rocket must react against something in order to drive the rocket forward. This is not the case at all. The gases as they explode, pass out through the funnel of the rocket, or the nozzle as it is technically called. In expanding, these gases react against the sides of the nozzle, causing the rocket to be driven forward. Professor Goddard has carried on extensive experiments at Clarke University in Worcester, Mass., wherein he has proven that the rocket gives even better results in a vacuum than it does in an air-filled chamber. A complete article on this subject appeared in the February, 1920, issue of SCIENCE AND INVENTION Magazine. You will find there a complete explanation of how the rocket works.



This explains the action of a rocket and shows why the rocket will travel even in interstellar space. Gases do not need to react on any air.

Colored Gasoline

(2329) Mr. Homer Adams, Wainwright, Okla., asks:

Q. 1. What is ethyl gasoline and why the color found in some gasolines, such as red or green?

A. Ethyl gasoline is an anti-knock compound made from the raw materials, ethyl alcohol and lead. These two substances are treated with other compounds, which are not disclosed at the present time, and then reacted together and washed in sulphuric acid after which the halogen bearing compounds are added.

The ethyl fluid is tetra-ethyl-lead treated with halogen bearing compounds. The latter has been added to neutralize the effects of the lead oxides which have a tendency to attack the spark plug terminals. Since the addition of the halogen bearing compounds in the form of ethyline bromide and trichlor-ethyline. the spark plug difficulty has been eliminated. The knocks due to carbon and preignition are eliminated by using an anti-knock motor fuel such as this ethyl gasoline. Gasoline is colored by special dyes usually red or green which in no way affect the efficacy of the product.

Why toil for small wages?

RADIO

offers you BIG PAY!

Free Book tells how to Fill the Job You Want ... Many do it in only 9 Months

SPEED up your earning capacity ... get out of the low pay rut ... make more money than you ever made before . . . in Radio—the big-money business of today. Hundreds of men just like you are earning from $2,000 to $25,000 a year in this giant money-making industry.

Astounding World-Wide Opportunities Beckon To You

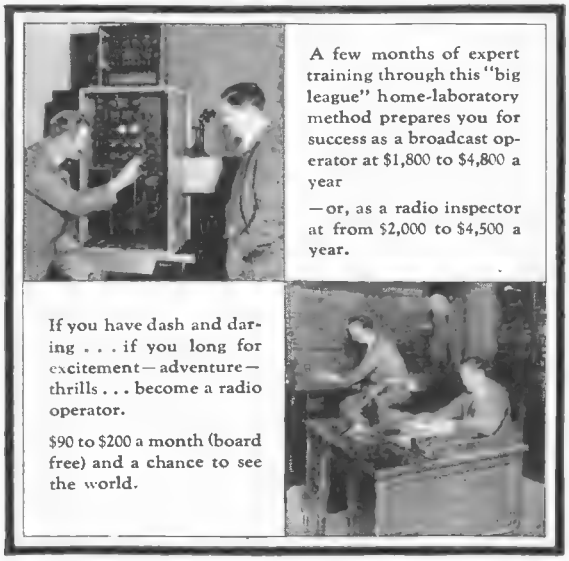
Be one of the fortunate men to get in on the ground floor of this big-money industry. Broadcasting stations and manufacturers are eagerly seeking capable graduates—and now nation-wide Radio telegraph service, telephony, television, photoradiograms have opened up new and amazing opportunities by the thousands!

Magnificent Laboratory Outfit Makes It Easy To Learn At Home

You don't have to know an antenna from a vacuum tube. By means of this marvelous, simplified home-training course, sponsored by the Radio Corporation of America ... you can now prepare for success in every phase of radio. The remarkable outlay of apparatus given to you with this course ... enables you to learn by actual practice how to solve every problem in Radio work ... such as repairing, installing and servicing fine sets. That's why you, too, upon graduation can have the confidence and ability to command big money.

Only Training Course Backed by Radio Corporation of America

Graduates of this school are always posted in newest up-to-the-minute developments in Radio. That's why they are always in big demand. The progress of Radio is measured by the accomplishments of the great engineers in the huge research laboratories of the Radio Corporation of America. This gigantic corporation sets the standards for the entire industry ... and sponsors every lesson in the course.


A few months of expert training through this "big league" home-laboratory method prepares you for success as a broadcast operator at $1,800 to $4,800 a year
—or, as a radio inspector at from $2,000 to $4,500 a year.
If you have dash and daring . . . if you long for excitement—adventure—thrills . . . become a radio operator.
$90 to $200 a month (board free) and a chance to see the world.

Money Back If Not Satisfied

This marvelous home-laboratory training practically insures your success by preparing you thoroughly in every phase of Radio manufacturing, servicing, broadcasting, photoradiograms, television and airplane radio equipment. As a student, you will receive an agreement signed by the president of this school assuring you of complete satisfaction upon completion of your training—or your money will be instantly refunded.

SPONSORED BY

RADIO INSTITUTE OF AMERICA

RCA

Free!

This fascinating book on Radio's glorious FREE opportunities . . . written by one of America's well-known radio experts.

RADIO INSTITUTE OF AMERICA,
Dept. EX-10, 326 Broadway, New York, N. Y.

Gentlemen: Please send me your FREE 50-page book which illustrates the brilliant opportunities in Radio and describes your laboratory-method of instruction at home.

Name .....

Address .....

"The Boss Was Stumped"

"He was trying to figure out a way to speed up the machines. I could see he was stumped and I asked him if he would let me try my hand at it.

" 'Go ahead,' he said, 'but I don't believe you can help much. Looks like an outside job to me.'

"So I started right in and pretty soon I had the whole thing worked out. The boss was watching me and I could see he was surprised.

" 'How did you learn all that?' he asked in that quiet way of his. And then I told him I'd been studying at home nights through the International Correspondence Schools.

"He didn't say anything more and I thought he had forgotten all about it until he called me in his office a few weeks later and said he was going to make me foreman and increase my salary $75 a month."

That's a true story of what spare-time study has done for just one man. There are thousands of others. Why don't *you* take up a home-study course with the International Correspondence Schools and prepare yourself to earn more money?

INTERNATIONAL CORRESPONDENCE SCHOOLS
"The Universal University"
Box 6257-F, Scranton, Penna.

Without cost or obligation on my part, please send me a copy of your 48-page booklet, "Who Wins and Why," and tell me how I can qualify for the position, or in the subject, *before* which I have marked an X:

TECHNICAL AND INDUSTRIAL COURSES

☐ Architect	☐ Automobile Work
☐ Architectural Draftsman	☐ Aviation Engines
☐ Building Foreman	☐ Plumber and Steam Fitter
☐ Concrete Builder	☐ Plumbing Inspector
☐ Contractor and Builder	☐ Foreman Plumber
☐ Structural Draftsman	☐ Heating and Ventilation
☐ Structural Engineer	☐ Sheet-Metal Worker
☐ Electrical Engineer	☐ Steam Engineer
☐ Electrical Contractor	☐ Marine Engineer
☐ Electric Wiring	☐ Refrigeration Engineer
☐ Electric Lighting	☐ R. R. Positions
☐ Electric Car Running	☐ Highway Engineer
☐ Telegraph Engineer	☐ Chemistry
☐ Telephone Work	☐ Pharmacy
☐ Mechanical Engineer	☐ Coal Mining Engineer
☐ Mechanical Draftsman	☐ Navigation ☐ Assayer
☐ Machine Shop Practice	☐ Iron and Steel Worker
☐ Toolmaker	☐ Textile Overseer or Supt.
☐ Patternmaker	☐ Cotton Manufacturing
☐ Civil Engineer	☐ Woolen Manufacturing
☐ Surveying and Mapping	☐ Agriculture ☐ Fruit Growing
☐ Bridge Engineer	☐ Poultry Farming
☐ Gas Engine Operating	☐ Mathematics ☐ Radio

BUSINESS TRAINING COURSES

☐ Business Management	☐ Business Correspondence
☐ Industrial Management	☐ Show Card and Sign Lettering
☐ Personnel Management	
☐ Traffic Management	☐ Stenography and Typing
☐ Accounting and C. P. A. Coaching	☐ English
	☐ Civil Service
☐ Cost Accounting	☐ Railway Mail Clerk
☐ Bookkeeping	☐ Mail Carrier
☐ Secretarial Work	☐ Grade School Subjects
☐ Spanish ☐ French	☐ High School Subjects
☐ Salesmanship	☐ Illustrating ☐ Cartooning
☐ Advertising	☐ Lumber Dealer

Name.....
Street
Address.....
City..... State.....
Occupation.....

If you reside in Canada, send this coupon to the International Correspondence Schools Canadian, Limited, Montreal, Canada

PLAY TUNES the Very First Day
ON REMARKABLE NEW INSTRUMENT

The "Octophone" is equipped with new patented invention that has enabled many to play tunes **in a few minutes! No knowledge of music required.** No long, tiresome practice. No expensive lessons. You learn to read music **automatically** while playing.

8 INSTRUMENTS IN 1

The "Octophone" is a complete orchestra in one instrument — **Ukulele, Tenor Banjo, Mandolin, Tenor Guitar, Mando-Cello, Tipie, Taro-Patch, Mandola.** Produces rich harmony, syncopated jazz. Astonish your friends. Loads of fun. Money-making chances. **Seven-day trial at our risk.**

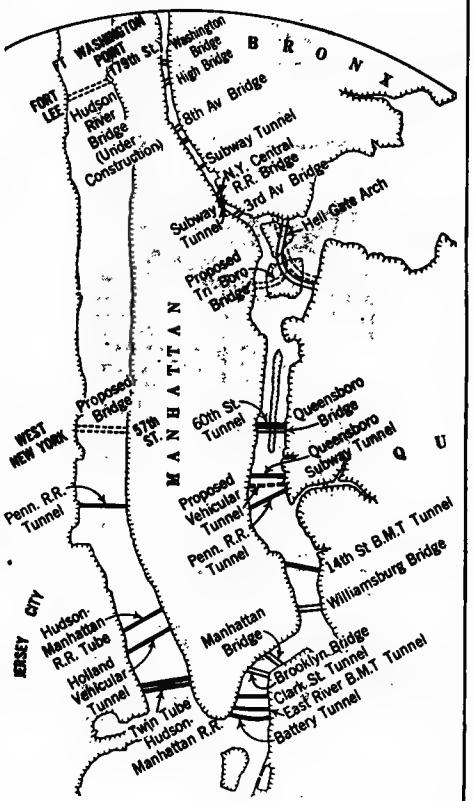
EASY TERMS! Write today for FREE particulars.
Ferry & Co., 1750 N. Damen, Dept. 125, Chicago, U.S.A.

New Hudson River Bridge to Carry Vehicles and Trains

(*Continued from page* 492)

and also extreme grades on the New York Side. This huge bridge design intended to cross the North River and relieve a great amount of traffic from New York to New Jersey, has been under consideration for more than forty years, and among its original charterers was Gustave Lindenthal, the eminent bridge engineer, who is president of the North River Bridge Company, the present proposers in conjunction with the Baltimore and Ohio Railroad.

The bridge plans also provide that the railroad tracks after they leave the bridge on the New York side, would pass down into a subway and remain underground throughout the loop, over which the trains could return after passing from the station. Only the station building would be located above the ground. On the New Jersey side the through tracks would be diverted to a belt line, connecting the various prominent railroads terminating on the river front.



New York City, a maze of tunnels and bridges! The site of the proposed new bridge, across the Hudson River at 57th Street, is to be noted at the left center of the map.

Dust!

(*Continued from page* 510)

Many volcanic eruptions send immense volumes of dust into the atmosphere.

In 1883, when Krakatoa erupted 4 cubic miles of solid rock were sent up into the air, the finest particles floated about for several years. The fact that meteors when they enter the earth's atmosphere are burned up and disappear leads to the conclusion that the resulting dust or remains must stay in the atmosphere in the shape of very fine dust or larger particles which gradually descend to the earth's surface.

Complete Short-Wave Manual

Up-to-the-Minute Data—All Worth-While Circuits
FULL SIZE BLUEPRINTS

Some of the finest programs are being broadcast over the short-wave bands. There are many reasons for this. Paramount among them all is the fact that that entertainment, broadcast in this band, can be received over distances which with the ordinary broadcast receiver would be impossible!

Thousands of letters, which pour in an unremitting stream into our offices, tell the same tale—it is a common and everyday matter to receive programs from all foreign countries, from the most distant climes. England, France, Germany, towns on the African continent, from every conceivable corner of the globe where a station is located—programs come in with surprising volume and clarity. One would think they were hearing a New York, Chicago or San Francisco station until the voice of the announcer, many thousands of miles away, discloses the true location of station.

The SHORT-WAVE MANUAL tells plainly how to construct all these short-wave circuits, which our tireless laboratory researches have shown to be most efficient.

Large size book (same size as Radio News) with a beautiful colored cover. Replete with illustrations, diagrams and with FULL SIZE BLUEPRINTS. This big valuable book will show you how to receive all the foreign countries clearly and easily. Write today for your copy.

Clip and Mail This Coupon **only 50c** the copy

EXPERIMENTER PUBLICATIONS, Inc.
Dept. 2510g, 381 Fourth Avenue, New York

Gentlemen:

Enclosed find 50c for which please send me a copy of THE SHORT-WAVE MANUAL.

Name .....

Address .....

City ..... State .....

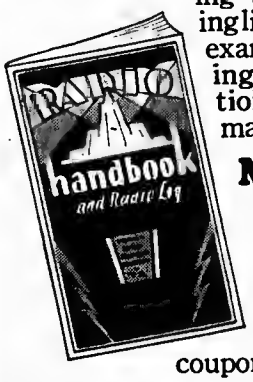
4 of the 40 Easy Ways to Make $3.00 an Hour In Your Spare Time in RADIO

THE four plans shown are but a sample of the many ways in which our members are making $3.00 an hour upwards, spare time and full time, *from the day they join the Association.* If you want to get into Radio, have a business of your own, make $50 to $75 weekly in your spare time, investigate the opportunities offered the inexperienced, ambitious man by the Association.

Our Members Earning Thousands of Dollars Every Week

The Association assists men to cash in on Radio. It makes past experience unnecessary. As a member of the Association you are trained in a quick, easy, practical way to install, service, repair, build and rebuild sets—given sure-fire money-making plans developed by us—helped to secure a position by our Employment Department. You earn while you learn, while you prepare yourself for a big-pay Radio position.

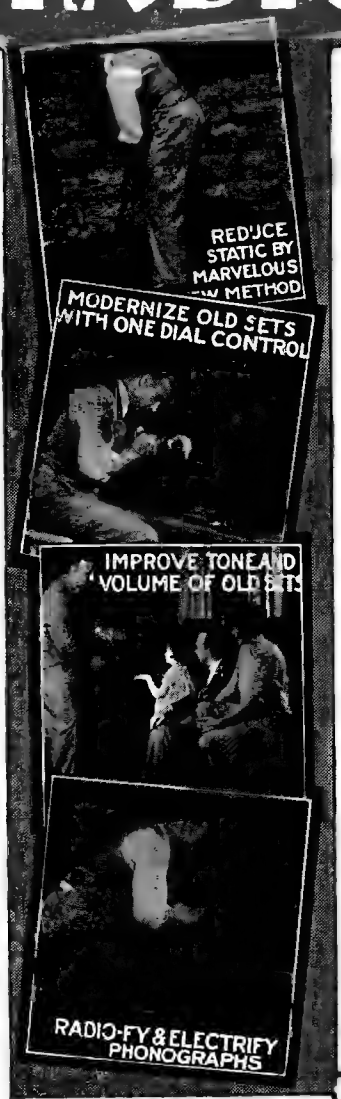
The Association will enable you to buy parts at wholesale, start in business without capital, help you get your share of the $600,000,000 spent annually for Radio. As a result of the Association, men all over the country are opening stores, increasing their pay, passing licensed operator examinations, landing big-pay positions with Radio makers.



Mail Coupon Today for the FREE HANDBOOK

It is not only chock-full of absorbing information about Radio, but it shows you how easily you can increase your income in your spare time. Mailing the coupon can mean $50 to $75 a week more for you.

Radio Training Association of America
4513 Ravenswood Avenue Dept. RN-10, Chicago, Illinois


REDUCE STATIC BY MARVELOUS
MODERNIZE OLD SETS WITH ONE DIAL CONTROL
IMPROVE TONE AND VOLUME OF OLD SETS
RADIO-FY & ELECTRIFY PHONOGRAPHS

Below are a few of the reports from those now cashing in on the "40 Easy Ways"

Clears $3,000.00 Frank J. Deutch, Pa. — "Since joining the Association I have cleared nearly $2,000.00. It is almost impossible for a young fellow to fail, no matter how little education he has, if he will follow your easy ways of making money."

$1,100.00 in 6 Weeks J. R. Allen, Calif. — "Have done over $1,100.00 worth of business in the last 6 weeks. Next month I am going to open up a store of my own. I never knew that money could come so fast and easy."

$25.00 a Week Spare Time N. J. Friedrich, N. Y.—"I have averaged $25.00 a week for the last 7 months even though I am not a graduate but just learning."

Training Lands Him Job R. C. Kirk, N. C.—"Your training has been very valuable to me. I landed a job with the big department store out here a few weeks ago because I had my membership card with me. There were a large bunch of applications ahead of me."

ACT NOW

If You Wish NO-COST Membership

For a limited time we will give to the ambitious man a No-Cost Membership which need not—should not—cost you a cent. For the sake of making more money now, and having a better position in the future, mail coupon below *now.* You'll always be glad you did.

Radio Training Association of America
Dept. RN-10, 4513 Ravenswood Ave., Chicago, Ill.

Gentlemen: Please send me by return mail full details of your Special No-Cost Membership Plan, and also a copy of your Radio Handbook.

Name .....

Address .....

City ..... *State* .....

Will You Accept a 1929 ATLAS

Given to readers of Science and Invention who take advantage of this offer now made in connection with

Webster's New International Dictionary The Merriam Webster

The "Supreme Authority"

A complete reference library in dictionary form, with 3,000 pages and type matter equivalent to a 15-volume encyclopedia, all in a single volume, can now be yours on the following remarkably easy terms:

The entire work (with 1929 ATLAS)

Delivered for $1.00

and easy monthly payments thereafter (on approved orders in United States and Canada). You will probably prefer the beautiful India-Paper Edition, which is

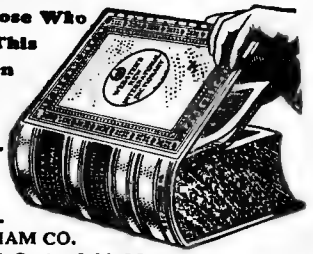
Reduced About One-Half

in thickness and weight as compared with the Regular Paper Edition

Over 408,000 Vocabulary Terms and in addition, 12,000 Biographical Names, nearly 32,000 Geographical Subjects, 3,000 pages, 6,000 illustrations.

Constantly improved and kept up-to-date. "To have this work in the home is like sending the whole family to college." To have it in the office is to supply the answers to countless daily questions.

To Those Who Send This Coupon NOW!



C. & C. MERRIAM CO.
Dept. S, Springfield, Mass.

Please send me free of all obligation or expense, complete information, including "125 Interesting Questions," with references to their answers, striking "Facsimile Color Plate" of the new bindings, with terms of your Special Atlas Offer on Webster's New International Dictionary to readers of Science and Invention. (10-29)

Name.....

Address.....

HOW FAST CAN YOU TAKE ORDERS

Big Profits For You In TIES and SHIRTS

Nothing hard about taking orders for this great eye-catching, money-saving SUPRA VALUE TIE LINE! Just show snappy new FREE Sample Outfit—get the order blanks ready, and the rest is easy. Even beginners make big profits in no time. Advance 1930 styles now ready. Equally fast selling BROADCLOTH SHIRT LINE just doubles your profits—builds big repeat business.

BIG FREE SELLING OUTFIT

Made in our own big mills. Sell on sight at factory prices. Let us show you what these "best sellers" will do. Write for attractive FREE Tie and Shirt Outfit today.

SUPRA VALUE SHIRT CO., Inc.
4925-A Hudson Blvd. No. Bergen, N.J.

I can make a good penman of you at home during your spare time. Write for my FREE BOOK, "HOW TO BECOME A GOOD PENMAN." Your name elegantly written on a card if you enclose stamp. Write today.

F. W. TAMBLYN, 424 Ridge Bldg., Kansas City, Mo.

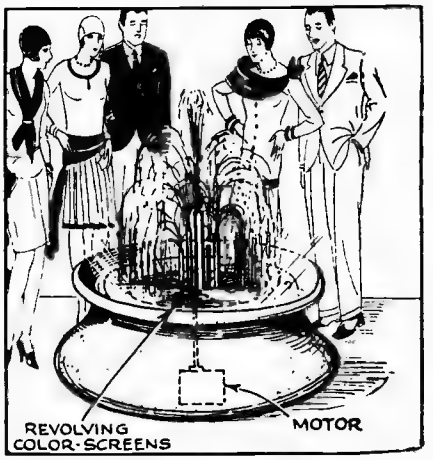
Who Will Build the Fastest Ship?

By James C. Young

(*Continued from page* 495)

Mechanically and structurally the Bremen marks an epoch—nothing less. Below the water line she departs a long way from accepted standards. Her bulbous nose extends outward twenty feet and backward fifty feet, bending downward, in the way of a heavy fin. And in this fin is the secret of the Bremen's steady structure and swift pace, to no small degree. It was developed in part as a result of submarine experience. At the extreme bottom the hull practically equals in width the extreme width of the main deck. Thus, the Bremen's greatest depth and weight being in the water, she might be called a submerged object, of which only the top skims the water. In effect, then, she is both airplane and U-boat.

Inside the big craft her mechanical arrangements command the first attention. She has two complete engine rooms that may be operated singly or in unison. Should accident affect the machinery in one, the other remains entire. Each has three turbines—high, intermediate and low pressure—attached to four shafts—twelve turbines in all. They operate the propeller shafts by single reduction gears.

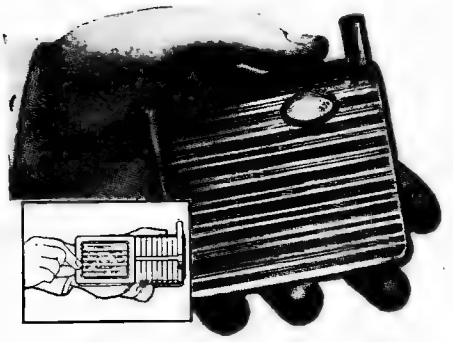


The "Bremen's" electric fountain, with ever-changing colors.

THERE is nothing especially new about the Bremen's mechanical basis, but in application a great deal has been accomplished. Needless to say, the change from coal to oil reduces her weight of fuel and storage space. And she has only twenty-one boilers, compared to the forty-odd in a ship such as our Leviathan, once a German craft. The Bremen's horsepower—120,000—is about twice that of the Leviathan, or twice as much power with half the number of boilers.

In a kind of well between stacks, stands the catapult. It is eighty-eight feet long, and operates as a device to shoot a plane off and upward. One and a half seconds to start! On the Bremen's first trip catapult and plane performed perfectly. Both will be used in the regular mail service from ship to shore, and also for passengers who may desire to go catapulting.

Toward the stern and bow, on every deck, stands an instrument more human than an adding machine. Ask the machine where you want to go, and read your answer in its electric signal. Merely push a button and the answering flash upon the glass diagram shows the way.



Safe Smoking for Autoists!

. . . . *smart smoking for all!*

With one hand on the wheel and BOTH eyes on the road, Ejector delivers a cigarette to your lips at the press of your thumb.

No fumbling with carton, no dangerous shifting of eyes. And a clean, uncrushed cigarette every time.

Ejector is the modern, *smart* and correct way to carry cigarettes.

Appealing designs at live dealers, or send $1.50 for Model "C." Free Literature.

THE LYONS MFG. CO.
Dept L Mt. Carmel, Conn.

EJECTOR
The Perfect One Hand
CIGARETTE CASE

There's an air of hospitality that you'll like
AT THE HOTEL
PICCADILLY
227 WEST 45th ST. at BROADWAY
NEW YORK

ADJACENT TO EVERY ACTIVITY
600 BRIGHT SUNLIT ROOMS
EACH WITH BATH,
ELECTRIC FAN, ICE WATER
SINGLE ROOM & BATH $3.00
DOUBLE ROOM & BATH $4.00
Exceptional Restaurant & Grille
WIRE AT OUR EXPENSE FOR RESERVATIONS
F. D. SOFIELD, *Managing Director*

6 Shot 22 Cal. BLANK Automatic
A REAL HOME PROTECTOR

Shoots six load—powerful shots—like expensive automatic in appearance. Construction, finish, durability—use for fun or self defense. Frightens thieves, tramps, dogs—fool your friends. Guaranteed absolutely safe. Automat cally loads magazine and ejects cartridges. SEND NO MONEY—Pay postmaster $4.85 on delivery, we pay the postage. 100 CARTRIDGES GIVEN FREE. FEDERAL 561 Broadway, New York City, Dept. A-1051

NO PERMIT or LICENSE REQUIRED

DEAFNESS IS MISERY

Multitudes of persons with defective hearing and Head Noises enjoy conversation, go to Theatre and Church because they Use Leonard Invisible Ear Drums which resemble Tiny Megaphones fitting in the Ear entirely out of sight. No wires, batteries or head piece. They are inexpensive. Write for booklet and sworn statement of the inventor who was himself deaf.

A. O. LEONARD, Inc., Suite 685, 70 5th Ave., New York

10,000 Buttons Command Service

SPEAKING of buttons—there are ten thousand of them, to turn on lights, summon stewards, and what not. A world of buttons, as it were. The Bremen designers installed an electric bulb in every possible spot where a human want could need one. The ship is exceptional in its lighting arrangements, easily the best seen in the port of New York. Bringing, as well, some new conceptions to American eyes, without being futuristic, the Bremen is modernistic. Its salon chandeliers take the form of clouded glass cut into long strips, medallions and designs unfamiliar to American eyes.

American Expert Discusses Bulbous Nose

MR. FERRIS, the American designer, discussed with the writer some of the developments in steamship construction.

"The bulbous nose was discovered fifteen years ago by our Navy Department," he said. "It operates in the way that a fish swims. Most members of the finny tribe are flat or round, generally a blunt body. If they had to swim half submerged and half on the surface they would make slow progress. But a fish swims submerged and the shape of the body is exactly suited to that kind of progress. This principle is exemplified in the snub-nosed ship.

"After the Navy Department's discovery the principle was applied to one merchant ship, considerably improving her speed over ships of similar power. Then came the war and an inclination to follow the known paths. Ship owners were not in a humor for experiments. Since the war we have gradually reached the point where marine development may be expected to go swiftly forward. Four years ago I used the snub-nosed principle in building the Iroquois and Shawnee for the Clyde Line, both of them faster ships than they would be with the usual keels.

"The Saratoga and Lexington of our Navy have bulbous bows, and both are turbo-electric drive ships. Undoubtedly this principle will increase the speed of future steamships. How fast can they go? Well, it is not only a question of physical possibilities, but of profitable operation. With our knowledge of structures and power we can build ships to do thirty knots or better. That brings us within the possibility of four days to Europe. Whether it will prove a matter of practical operation remains to be shown.

Shall We Build Larger Ships?

"IT is unlikely that ships will grow larger. The Leviathan is just under 60,000 gross tons, and I doubt if we shall build a vessel much larger. The problem is compression of weight and power to raise speed. No doubt we shall have thousand-foot ships. They can be built longer and larger. What purpose would they serve? A thousand-foot ship is a long structure. Think of that—a thousand feet of solid structure driving through the water at high speed.

"Marine construction is on the point of vast development. Although the ocean race halted on the coming of the war, and has been delayed until now, we have learned a great deal about ships in that time. The science has not lagged. Why, it is no longer ago than 1910 that I built cargo boats with sails as well as engines. The new ships of the United States lines will excel any ever built. How could we do less? The Germans have been daring in their departures on the Bremen, going farther in many particulars than any of us have gone before." Their new ships

This FREE BOOK

answers important questions

this famous PLEDGE removes *risk* in buying a used car!

"How to Judge a Used Car"—written out of the experience of men who buy thousands of used cars for resale—shows you step by step how to pick a *good* used car at lower cost! Send the coupon now for your *free* copy.

This valuable free book explains how to judge a used car's actual condition, how to learn the year model, how to set a fair price on a car offered you by a friend, what speedometer figures show, how to avoid "orphans," what code prices mean—why you get five days' driving trial, 30-day guarantee on certified cars and plainly marked prices under the terms of the famous Studebaker Pledge.

Read this free book, "How to Judge a Used Car." It will bring all of this expert counsel to you without cost. Use the coupon below *now!*

Pledge to the Public on Used Car Sales

1 Every used car is conspicuously marked with its lowest price in plain figures, and that price, just as the price of our new cars, is rigidly maintained.

2 All Studebaker automobiles which are sold as CERTIFIED CARS have been properly reconditioned, and carry a 30-day guarantee for replacement of defective parts and free service on adjustments.

3 Every purchaser of a used car may drive it for five days, and then, if not satisfied for any reason, turn it back and apply the money paid as a credit on the purchase of any other car in stock—new or used. (It is assumed that the car has not been damaged in the meantime.)

© 1928 The Studebaker Corporation of America

MAIL THIS COUPON

THE STUDEBAKER CORPORATION OF AMERICA, Dept. 1710, South Bend, Ind.
Send me free booklet, "How to Judge a Used Car"

Name.....

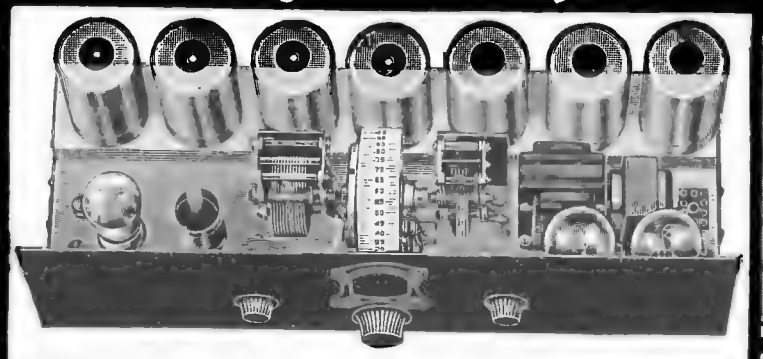
Street.....

City..... *State*.....

STUDEBAKER

Builder of Champions

The NEW H-F-L Mastertone Laboratory Made Receiver



Completely Built and Assembled by H-F-L Engineers—*Shipped ready to Operate*

All metal completely shielded chassis: 7" x 21" x 7½". Fits nearly all consoles. 11 tubes operating at peak efficiency [5-224; 3-227; 2-245; 1-280.] Single dial positive one-spot tuning; Humless AC Operation; Uses 5 Screen-Grid tubes, 5 Tuned R. F. Circuits; High Power Screen-Grid detector, with 175 volts impressed on plate; Automatic line voltage control inbuilt holds voltage against fluctuating; 100-Volt DC Dynamic field supply incorporated; 3 stage Phonographic amplifier; Finest quality precision made parts.

Amazing Power

Startling realism! Unfailing accuracy! Its great power and sweet tone awe and thrill, setting new standards of performance achieved by H. F. L. engineers after two years of tireless research and tests under all conditions.

Keenest Sensitivity

Unlike any ever known! Gets distant stations clearly, sharply, distinctly with only wire screen or metal plate aerial built in cabinet.

Highly Developed Circuit

Intermediate employs 4 screen-grid tubes with 5 tuned filter circuits, easily adjustable to peak of tuned frequency. Positive 10 Kilocycle selectivity. Most highly engineered receiver ever built.

The New Audio System

Uniform amplification over entire musical scale. Operates with dynamic, magnetic or horn speakers without a bit of hum.

The H-F-L Power Master

Not an ordinary power pack, but a specially developed unit of the Mastertone, built separately to simplify installation. Has oversized transformer, full wave type 280 rectifier tube.

Built by Hand—Yet Low in Price—

Quality—not quantity—the H-F-L Mastertone standard. One demonstration will convince you that its the master receiver of all times. Fully guaranteed.

Write today for complete description and price.

HIGH FREQUENCY LABORATORIES
28 North Sheldon St. Dept. 29 Chicago, Ill.

JOSEPH FALK, Allston, Mass., earned $8,000 playing a Conn saxophone while in college. Appeared in 8 countries, plays 22 instruments, nearly all Conns.

Popular

LEARN saxophone, cornet, trombone—any band instrument. Be popular—make more money. It's easy. Play tunes first day. Ready for band or orchestra in 60 to 90 days. The world's greatest band leaders and soloists endorse Conns. Easiest blowing qualities; speediest action. Yet these superior instruments cost no more. Write for Free Book and full details of FREE TRIAL and Easy Payment offers. Mention instrument.

C. G. Conn, Ltd. 1056 Conn Bldg. Elkhart, Ind.

CONN
WORLD'S LARGEST MANUFACTURERS of BAND INSTRUMENTS

Choice of 1200 Newest RADIO VALUES

SEND for our 1930 catalog. Filled with amazing values in screen grid radios, push pull audio, consoles, kits, parts. All standard makes and guaranteed merchandise.

FREE

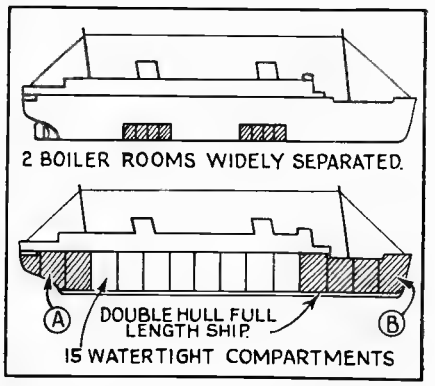
WESTERN RADIO MFG. CO.
128 W. LAKE ST. CHICAGO ILL.

are an evolution of several sciences, a natural product. Ours will go a step beyond. In this country we have the accumulated knowledge of the world's greatest power experts. What will prevent us from building faster ships than anybody ever built before?"

The United States liners will cost about $25,000,000 each and should be ready in two years. Report places them at 55,000 gross tons, and a thousand feet long. Experiments are under way in the model basin at Washington to determine matters of construction. That they will be big craft—even the very biggest—is indicated by the plans for a passenger carrying capacity of 3,000 persons.

Other Nations in the Race

MEANWHILE the other maritime powers are making ready to enter the race, in which the Germans have obtained a signal start. Their two ships—the Europa and Bremen—and the French Line's Ile de France are the only vessels of the stellar class built since the war. Anything above 40,000 tons may be considered of the first grade in ocean mammoths. The Ile de France, though not so fast as the Germans, is a model of elegance. She is to be followed by a new queen of her fleet, which French Line officials also have said will be "the biggest and fastest afloat."



The "Bremen" has two separate boiler rooms, also she can keep afloat with compartments (shown shaded) flooded

The British fleet, big and numerous in fast ships, antedates the war in all particulars and is German in no small part of its origin. The Bremen has scrapped the speedsters of the British lines. None of them can get much nearer than a day to the Bremen, excepting the Mauretania. And it may be affirmed that the British will not stand idly by, for "Britannia rules the waves." Or she used to rule them with her fast ships in the Atlantic trade.

The White Star Line has laid the keel of one super-ship and projected another, but the first was stopped when hardly begun, and nothing definite has come of the second plan. Undoubtedly the Bremen's performance was awaited before pursuing construction. The Cunard, too, has discussed new ships, without action. Again the Bremen was the object of attention.

Now come the two Italian lines of the major class—the Lloyd Sabaudo and the Navigazione Generale Italiana — with plans for two monster ships. They expect to cut the nine days, New York to Naples, by almost a third, six and a half days. Much lies behind this, Italian pride, for one thing, and a new bid to induce tourist travel, for another. The Italian ships have done well in the last year or two and no one may doubt that they will be behind in the ocean race. Among their proposed innovations is refrigerated air to cool one in Mediterranean sunshine.

Financial Information

By Alfred Caddell, Financial Editor

Question: What do you think of Electric Investors as an investment? A. H. R., Camden, N. J.

Answer: The common stock of this company has a record of earnings that entitles it to be classed as an investment. For the twelve months ending June 30, 1929, after taxes and interest were deducted, a net income of $12,272,028 was reported, equivalent after dividends on the $6 no-par preferred stock, to $11.75 a share earned on 948,364 shares of no-par common. A split-up of the common, with valuable rights, is predicted. The growth of this utility has been consistent and is indicative of the tremendous expansion in the electric utility field which has been and is still progressing.

Question: I have noted the tremendous increase in popularity in the outboard motor field. What is your opinion of Johnson Motors? C. A. M., Port Jefferson, L. I.

Answer: The Johnson Motor Company is one of the outstanding outboard motor manufacturers. At the close of its fiscal year which will end September 30th, it is expected that the company will show net profit in excess of $500,000, which is equivalent to more than $5 a share on the 95,000 shares of common outstanding. This would compare with $257,069 earned in the fiscal year 1928, or $2.70 a share. It is reported that sales are running nearly 50 per cent in excess of last year.

Question: How does Bendix Aviation stand in your opinion? P. T., Wichita, Kan.

Answer: Bendix Aviation must of necessity be regarded as a speculation, because it has yet to show earning power, having only recently been organized. However, this company is one of the most attractive in the aviation field. Sponsored by General Motors, it has absorbed some of the leading accessory companies in the carburetor, magneto, wheel, instrument and allied aviation accessory fields. Inasmuch as all aircraft must embody this company's or a similar company's products, Bendix may be regarded as one of the fundamental companies engaged in the aircraft field and its earnings should consequently grow with the growth of aviation.

Question: I own 100 shares of Gillette Safety Razor. I notice that there has been considerable market activity in this stock but not much of an advance. What do you know about it? J. H. G., Springfield, Ill.

Answer: Gillette has undergone persistent liquidation on account of settlement of an estate involving large holdings. But it is now believed that most of this selling is out of the way, which places the company in a position to respond to the continuous increase in its earnings. In this connection, it must be recalled that with one exception Gillette's profits have made gains yearly during the past 23 years. Gillette has met great success in recent years in developing its foreign business, and is now developing new lines apart from razors and blades, such as office goods, surgical instruments and other special devices.

Information on securities will be furnished readers of Science and Invention free of charge by mail and through these columns. A 2-cent stamped, self-addressed envelope should be included in your letter. Address your inquiries to

The Financial Editor, Science and Invention, 381 Fourth Avenue, New York City.

CORRECTION: Due to an oversight, copyright credit to New York Stock Exchange for photos used on page 446 of the September issue was inadvertently omitted.

BE AN ARTIST!

— and be your own boss

IF you like to draw, why drudge when success and a good income may be yours through art training? Publishers pay millions of dollars yearly for illustrations. Many successful Federal Students are earning from $2500 to $6000 a year — some even more.

If you hold yourself down to a routine job you may always do uncongenial work. But if you like to draw and are willing to train your talent, your art ability may help you to success in life.

Through the Federal Course in Illustrating more than fifty famous artists give you the benefit of their methods of Illustrating, Cartooning, Lettering, Poster Designing, Window Card Illustrating, etc. You may learn through the experience of these successful artists how to bring your own drawings to a professional standard. They understand the methods that make art pay well.

You can keep your present position while gaining your art training. Through the Federal Course you learn at home in your spare time. Hundreds of Federal Students have already proved by their professional success the value of this home study instruction.

Vocational Art Test—Free

Find out about your drawing ability by sending in the Free Vocational Art Test we offer. Just write your name, age and address on the coupon and we will send this Test together with a copy of the book "A Road To Bigger Things" without charge or obligation. Why drudge at uncongenial work when the chance to plan your own work and be your own boss may be yours through Art Training? It is important that you take your first step out of the rut by mailing the coupon today.

FEDERAL SCHOOL OF ILLUSTRATING

10339 Federal Schools Building
Minneapolis :: Minnesota

Federal School of Illustrating,
10339 Federal Schools Building,
Minneapolis, Minnesota.

Please send me free book, "A Road to Bigger Things," and Standard Art Test.

*Name*_____

*Age*____ *Occupation*_____

*Address*_____

INVENTORS

Protect Your Ideas

Send for our Guide Book, HOW TO GET YOUR PATENT, and Evidence of Invention Blank, sent Free on request. Tells our terms, methods, etc. Send model or sketch and description of your invention for INSPECTION and INSTRUCTIONS FREE. TERMS REASONABLE. BEST REFERENCES.

RANDOLPH & CO.
PATENT ATTORNEYS
Dept. 172, Washington, D. C.

Name.....

Street.....

City.....

PATENTS

MUNN & CO.

PATENT ATTORNEYS

Associated since 1846 with the Scientific American

SCIENTIFIC AMER. BLDG. Washington, D. C.
SCIENTIFIC AMER. BLDG. 24-26 West 40th St., N. Y. C.
TOWER BUILDING - Chicago, Ill.
HOBART BLDG., San Francisco, Cal.
VAN NUYS BLDG., Los Angeles, Cal.

Books and Information on Patents and Trade-Marks by Request

Associates in All Foreign Countries

PATENTS

BOOKLET FREE HIGHEST REFERENCES
PROMPTNESS ASSURED BEST RESULTS
Send drawing or model for examination and advice.
WATSON E. COLEMAN, Patent Lawyer
724 9th Street, N. W., Washington, D. C.

NEW YEAR - NEW IDEA
PATENT YOUR IDEAS
Call or send me a sketch of your invention. Phone LONgacre 3088
FREE Inventors Recording Blank Confidential Advice
U. S. and Foreign Patents secured by
Z.H.POLACHEK Reg. Patent Attorney Consult. Engineer
1234 Broadway, New York

PATENTS

WRITE FOR FREE INSTRUCTIONS
Send drawing or model for examination.
CARL MILLER, Patent Attorney
Former member Examining Corps, U. S. Patent Office
261 McGill Building, Washington, D. C.

To be sure of getting your copy each month, subscribe to SCIENCE AND INVENTION, $2.50 year. Experimenter Publications, Inc., 381 Fourth Avenue, New York City.

PATENT ADVICE

CONDUCTED BY JOSEPH H. KRAUS

In this Department we publish such matter as is of interest to inventors and particularly to those who are in doubt as to certain patent phases. Regular inquiries addressed to "Patent Advice" cannot be answered by mail free of charge. Such inquiries are published here for the benefit of all readers. If the idea is thought to be of importance, we make it a rule not to divulge all details, in order to protect the inventor as far as it is possible to do so.

Should advice be desired by mail, a nominal charge of $1.00 is made for each question. Sketches and descriptions must be clear and explicit. Only one side of sheet should be written on.

NOTE:—Before mailing your letter to this department, see to it that your name and address are upon the letter and envelope as well. Many letters are returned to us because either the name of the inquirer or his address is incorrectly given.

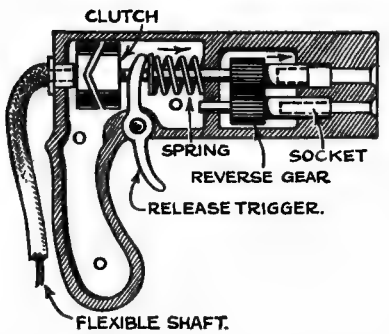
Power Wrench

(1189) Leonard Gray, Livingston, Calif., has designed a power driven speed wrench. He asks whether we advise him to apply for a patent.

A. 1. Power driven speed wrenches are employed in practically every large factory where there is a use for such an apparatus.

While your speed wrench differs slightly from other wrenches of a similar type, we do not consider it to be an improvement.

We would not advise further action.



This is a suggestion for a power speed wrench to tighten and loosen nuts.

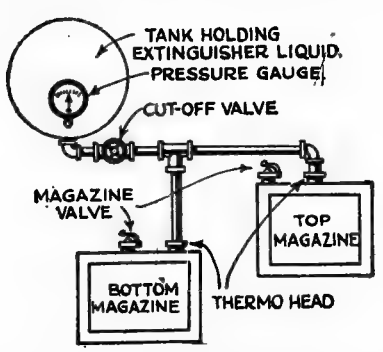
Film Box Fire Extinguisher

(1190) D. H. Suitt, Palace Theatre, Jacksonville, Texas, has designed a liquid fire extinguisher to put out fire in film-boxes. This consists of a fusible link connected with a tank of extinguisher fluid, the liquid in which tank is maintained under pressure.

A. 1. Why use a liquid fire extinguisher to put out the fire in film boxes when an ordinary air-shut-off smothers the flame and is less likely to damage the film? We certainly fail to see any advantage in your fire extinguisher principle.

Most projecting machines are so arranged that they can take care of any film fire which may occur in either the top or bottom magazine. Furthermore, fires at these points very rarely occur. The flame is generally started between the upper and the lower magazine and any shut-off which will prevent it from getting into the magazines saves both rolls of films.

We see no advantage and would not suggest further procedure.



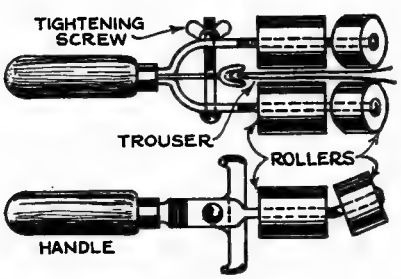
This device was suggested by a writer as a means for extinguishing fires in motion-picture projectors.

Trouser-Pressing Device

(1191) John Watt, Seattle, Washington, has designed a system for the pressing of trousers while the individual is wearing them.

A. 1. Many attempts have been made to develop mechanisms for creasing the trousers while the person is wearing them. Up to the present time, no practical method has been devised.

We do not think that the system which you have suggested is any more serviceable than those heretofore designed. There is, however, one way to determine this; build a working model and give it a thorough trial. Such a model will probably not cost more than $25.00. You should have such a model in order to interest the manufacturer. At the same time, after building it, you might be convinced that patenting the system would not be the best procedure until perfected and you would consequently save many dollars.



The rollers are to be heated and used for creasing trousers. Nothing is to be done to the sides of the pants.

You must further remember that many people like to have their trousers pressed in their entirety and are not satisfied with just a sharp line down the front. If the rest of the trouser leg is baggy it would look foolish to have a straight front edge. One tailor some years ago devised a system for running a bead down the front of the trousers which was sewed permanently in place and which guaranteed a constant crease at the front. We do not know what became of this idea, but it is not very likely that the method was successful.

PATENTS

At the right is a view of my drafting and specification offices where a large staff of experienced experts are in my constant employ.

All drawings and specifications are prepared under my personal supervision.

My Patent Law Offices Just Across Street From U.S. Pat. Office

Protect Your Ideas

Take the First Step Today—Action Counts

If you have a useful, practical, novel idea for any new article or for an improvement on an old one, you should communicate with a competent Registered Patent Attorney AT ONCE. Every year thousands of applications for patents are filed in the U. S. Patent Office. Frequently two or more applications are made for the same or substantially the same idea (even though the inventors may live in different sections of the country and be entirely unknown to one another). In such a case, the burden of proof rests upon the last application filed. Delays of even a few days in filing the application sometimes mean the loss of a patent. So lose no time. Get in touch with me at once by mailing the coupon below.

Prompt, Careful, Efficient Service

This large, experienced organization devotes its entire time and attention to patent and trademark cases. Our offices are directly across the street from the U. S. Patent Office. We understand the technicalities of patent law. We know the rules and requirements of the Patent Office. We can proceed in the quickest, safest and best ways in preparing an application for a patent covering your idea. Our success has been built on the strength of careful, efficient, satisfactory service to inventors and trademark owners located in every state in the Union.

Strict Secrecy Preserved—Write Me in Confidence

All communications, sketches, drawings, etc., are held in strictest confidence in strong, steel, fireproof files, which are accessible only to authorized members of my staff. Feel free to write me fully and frankly. It is probable that I can help you. Highest references. But FIRST—clip the coupon and get my free book. Do THAT right now.

No Charge for Information On How to Proceed

The booklet shown here contains valuable information relating to patent procedure that every inventor should have. And with it I will send you my "Record of Invention" form, on which you can sketch your idea and establish its date before a witness. Such evidence may later prove valuable to you. Simply mail the coupon and I will send you the booklet, and the "Record of Invention" form, together with detailed information on how to proceed and the costs involved. Do this NOW. No need to lose a minute's time. The coupon will bring you complete information entirely without charge or obligation.

Clarence A. O'Brien

Registered Patent Attorney
Attorney-at-Law

Member of Bar of: Supreme Court of the United States; Court of Appeals, District of Columbia; Supreme Court, District of Columbia; United States Court of Claims.

PRACTICE CONFINED EXCLUSIVELY TO PATENTS, TRADEMARKS AND COPYRIGHTS

Inventors *Write for these* Free Books

Mail this Coupon *Now*

CLARENCE A. O'BRIEN
Registered Patent Attorney
and Attorney-at-Law
53-W Security Savings & Commercial Bank Bldg.
WASHINGTON, D. C.
—or—
Suite 1106, Woolworth Bldg.
NEW YORK CITY

Please send me your free book, "How to Obtain a Patent," and your "Record of Invention" form without any cost or obligation on my part.

Name .....

Address .....

.....

(Important! Write plainly and address office nearest you)

PATENTS
TRADE-MARKS

Service

Without charge or obligation, we will inform you on any questions you may put to us touching on patent, trade-mark and copyright law. You may ask: "Should I protect myself by patent, or register under the trade-mark or copy-right laws? What kind of a patent should I obtain?" and many other questions that may occur to you. These are vital points to consider and questions will be cheerfully answered.

Evidence of Conception

Before disclosing your invention to anyone send for blank form, "EVIDENCE OF CONCEPTION," to be signed and witnessed. As registered patent attorneys we represent hundreds of inventors all over the United States and Canada in the advancement of inventions. The form, "Evidence of Conception," sample, instructions relating to obtaining of patents and schedule of fees sent upon request.

LANCASTER & ALLWINE
270 Ouray Bldg., Washington, D. C.
Originators of forms "Evidence of Conception"

$300,000
For This Invention

That's what Eastman Kodak paid for the Autographic idea. Thousands of other inventions are needed and offer enormous opportunities for earning fortunes. If you are of an inventive turn of mind, why not concentrate on things that are really NEEDED? Get Raymond Yates's new book,

1,000 Needed Inventions

Costs only $1.50 and may start you thinking along the right lines. You'll get nowhere just fussing around. Concentrate on what the industries need, and on what the public wants. Mr. Yates's book tells you what these things are. Send no money. Just write postal. Pay mail man $1.50 plus postage when book arrives. Your money back if you want it. This offer limited. Write now and get on the right track. (Outside U. S., $1.70 cash with order.) Address

Bureau of Inventive Science 710 Wisner Bldg. Rochester, N. Y.

INVENTORS

We have been in business 30 years. If your invention or patent has merit, send details or model, or write for information. Complete facilities. References.

ADAM FISHER MFG. CO.
205-D St. Louis, Mo.

INVENTORS' MODELS
Mechanical Specialists for over 20 years. Rendering Complete Service to the man with an idea.
Labor Saving Machinery Designed & Built
Circular - References - Guarantee - Free
BERNARD & HELLER ~ 31 East 17th St., N.Y.C.

INVENTORS who derive largest profits know and heed certain simple but vital facts before applying for patents. Our book, Patent-Sense, gives these facts; sent free. Write

LACEY & LACEY
644 F STREET WASHINGTON, D. C.
Established 1869

MONEY **MYSTERY GAS LIGHTER** MONEY
JUST OUT. LIGHTS GAS INSTANTLY WITHOUT SPARKS OR FLAME · SELLS LIKE WILDFIRE WHEREVER GAS IS USED — RETAILS FOR 25¢
MAKE $25. A DAY
SAMPLE FREE
PACKED ON INDIVIDUAL CARDS WITH INSTRUCTIONS
RUSH $1.00 FOR GROSS or 10¢ FOR DOZ.
New Method Mfg. Co., Box 23-10, Bradford, Pa.

A Merry-Go-Round Demonstrates Einstein's Theory

By Donald H. Menzel, Ph. D.

(*Continued from page* 517)

an apple more than a pear, a doughnut, or a pumpkin pie.

If I had said, "Objects fall because of their heaviness," you would not think I had explained much. Yet, *gravitation* is derived from a latin word that means just this. When you speak of the force of gravitation, you are speaking of the force of heaviness. Thus analyzed, you see that gravitation does not explain anything. It merely gives a name to the mystery.

P.—Aristotle's statement, "Anything that has weight is naturally endowed with the power of moving toward the center of the earth," then, is really not so far

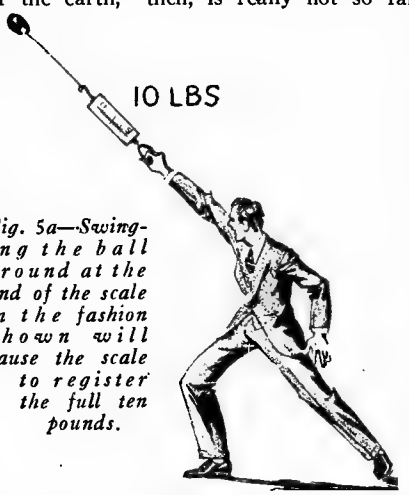


Fig. 5a—Swinging the ball around at the end of the scale in the fashion shown will cause the scale to register the full ten pounds.

removed from Newton's much more recent law of gravitation.

R.—That is true. Newton's real contribution was not so much the fact that he supposed an attractive force existed (in which he evaded the issue) but that he gave mathematical form to his hypothesis and, notwithstanding the still mysterious character of gravitation, showed that he could account for the motion of the celestial bodies by his law. But come! Let's get on that merry-go-round, I ought to be able to demonstrate Relativity there, pretty effectively. (Takes a billard ball from his pocket and lays it on the flat surface of the suit-case he is carrying.)

R.—Note that while the merry-go-round is standing still, this ball remains motionless. Now watch.

(The merry-go-round starts.)

L.—It is moving directly outward. (Figure 2).

P.—There is no secret about that. The centrifugal force acts on the ball. Of course it rolls away from the center. The motion arises from the merry-go-round's rotation.

R.—You are, I fear, too prejudiced by the fact that you see the trees of the park apparently circling about you. If those outer regions were in total darkness, so that you could not see the rotation, I doubt if you would consider the problem so self-evident.

P.—Why not? Certainly I should still feel the effect of the centrifugal force!

R.—But it would not be so easy to determine that the force arises from true rotation. I venture to predict that you might well consider that there is gravitational force, outside there, in the unknown darkness, attracting you. The ball tends to move outward. I am sure that it would be quite possible to account for the motion of the ball by such a supposition.

(*Continued on page* 566)

All 3 for 50¢
Complete New Novels by 3 Famous Authors

Real he-man stories, these! New Stories of the West of Old—when guns flamed and the covered wagon was a familiar sight. Now a half-dollar brings you all 3 novels in magazine form (shown above). Each written by a famous author of Western Tales—J. Samuel Sisco, Charles Alden Seltzer, and Charles Wesley Sanders.

Men Who Made History!

Meet young Benson, that fighting fool who enjoyed bucking odds with his gun. Hit the trails of gold with Dutch Schultz, happy-go-lucky adventurer of the mining camps. Meet Parson Bill, that strange combination of preacher and fighter, who could handle a gun with the best of them. Meet them all—reckless, fighting, romantic adventurers. They wait to give you many an hour's reading joy within the pages of these 3 great novels.

These Same Novels Would Ordinarily Cost You $6.00

if you bought them in the book stores. By printing in magazine cover style we save you 11 times what they would ordinarily cost you. Imagine paying only 50c for 3 complete $2 novels!

Mail This Coupon Today Send for them by enclosing 50c with the coupon below, and we will forward all 3 novels, postpaid, by return mail. Do it now, while they last.

NOVEL MAGAZINE CORPORATION
Dept. 2510-Z, 381 Fourth Ave., New York, N. Y.

Gentlemen:

Please send me the 3 complete novels, GUNS O' HELL, SIX-GUN JUSTICE and MAN-SIZE. I enclose 50c (in stamps or coin) to pay for them.

Name .....

Street .....

City ..... State .....

Making Sound Behave

By John De Quincey

(*Continued from page* 513)

words: "Every partially or nearly wholly enclosed body of air assumes a rhythmic vibration which will resound either as a tone or as a so-called reverberation whenever that air-body is agitated; the larger the volume of air the slower the rhythm of the tone or of the reverberation will be." For example, an organ pipe emits a certain note when a rhythmic vibration is set up by the agitation of its air column. This principle was accepted so far as organ pipes and the like were concerned. But Berliner declared that it applied beyond these bounds, affirming that a hall is merely an enlarged organ pipe so far as this principle is concerned.

Accordingly, he reasoned, that the cause of the distressing reverberation of a hall is due to the agitating of its enclosed air-body by the speaker's voice. In other words, that the reverberation in a hall is nothing less than the distinctive note of its air column, which on account of its large dimensions has a vibration rate too low for the human ear to distinguish as a distinctive note, recognizing it only as a vague booming sound.

His second proposition gets right to the heart of the problem: The harder or the more rigid the walls are which enclose an air-body the more intense will be its individual tone or its reverberation."

He took a leaf from his experiences in perfecting the gramophone, and proceeded to illustrate the propositions just cited: "Many years ago when I began my investigations which led up to the Gramophone," he said, "I was bothered considerably by disturbing noises caused by the horns which I used as sound collectors. Individual notes would be recorded and would reproduce much louder than other notes by the same singer or from the same musical instrument. I soon discovered that the disturbing sounds were always in the same key and that their notes corresponded to the individual note of the horn used for recording them. These horns were at that time usually several feet long and had flared openings, or so-called bells, from eight to twelve inches in diameter. Their individual note was well within the register of the male voice, so that hardly a song or a musical composition could be recorded but the disturbance took place. Soprano voices were not so much affected by it, but the instruments used for accompanying the voice were.

"I finally discovered that punching a certain number of small holes into the sides of the horns would destroy their individual resonance, thus removing the trouble. Such perforated, or as we used to call them, 'ventilated,' horns faithfully transmitted all sounds equally well to the recording diaphragm and permitted perfect recording, and with all larger horns perforations have been employed ever since. But when horns of this same large size were employed in reproducing machines the disturbance of individual resonance was not noticed because the pressure of the sound vibrations came from the diaphragm outwards, and therefore the cause of the resonance, which is rhythmic elastic compression of enclosed air, did not occur."

Remembering this experience he proceeded to check on it with a lucid bit of logic and a unique experiment. Take the violin," he said, "it contains an enclosed body of air. It ought therefore to have an individual tone, or note. But if that

PATENTS TRADE-MARKS AND COPYRIGHTS

VICTOR BUILDING

Our New Building, Nearly Opposite U. S. Patent Office, Specially Erected by Us for Our Own Use

OUR OFFER:

For the Protection of Your Invention

YOUR FIRST STEP — The inventor should write for our blank form "RECORD OF INVENTION." Before disclosing your invention, a sketch and description should be made on the blank sheets of our "RECORD OF INVENTION" and signed by the inventor and witnessed, sent to us, and we will place it in our fireproof secret files. WE WILL ALSO GIVE OUR OPINION as to whether the invention comes within the Patent Office definition of a patentable invention. This "Record of Invention" will serve as "proof of conception" until the case can be filed in the Patent Office. THERE IS NO CHARGE OR OBLIGATION FOR THIS SERVICE.

Write for Our Five Books Mailed Free to Inventors

Our Illustrated Guide Book

HOW TO OBTAIN A PATENT

Contains full instructions regarding U. S. Patents. Our Methods, Terms, and 100 Mechanical Movements illustrated and described.

OUR TRADE-MARK BOOK

Shows value and necessity of Trade-Mark Protection. Information regarding TRADE-MARKS AND UNFAIR COMPETITION IN TRADE.

OUR FOREIGN BOOK

We have Direct Agencies in Foreign Countries, and secure Foreign Patents in shortest time and at lowest cost.

PROGRESS OF INVENTION

Description of World's Most Pressing Problems by Leading Scientists and Inventors.

Delays Are Dangerous in Patent Matters

WHEN THE INVENTOR WISHES THE APPLICATION FILED WITHOUT DELAY, HE SHOULD HAVE HIS CASE MADE SPECIAL IN OUR OFFICE to secure protection, save correspondence and secure early filing date in Patent Office. He should send us a model, sketch or photograph, with a description of his invention together with $25.00 on account. We will make an examination of the U. S. Patent Office records to learn whether the invention is patentable. If it is we will prepare the official drawings immediately and forward them for approval and execution. If the invention is not patentable we will return the fee less the cost for the search.

Payment of Fees in Installments

It is not necessary that the total cost of a patent be paid in one payment. Our custom is to permit our clients to pay for their applications in three installments as the preparation of the application progresses in our office. Our Large, Comprehensive Organization has been established for 30 years and offers Prompt, Efficient and PERSONAL SERVICE by experienced Patent Lawyers and Draftsmen. Every case is in charge of a Specialist. Our Lawyers practice in all U. S. Courts and defend clients in suits involving Patents, Trade-Marks and Copyrights. ALL COMMUNICATIONS AND DATA strictly Secret and Confidential. We shall be glad to have you consult us, or to answer any questions in regard to Patents, Trade-Marks or Copyrights without charge.

Highest References—Prompt Service—Reasonable Terms

FREE COUPON

VICTOR J. EVANS & CO.

Registered Patent Attorneys : Established 1898

MAIN OFFICES: 715 Ninth St., Washington, D. C.

BRANCH OFFICES: 1007 Woolworth Bldg., New York City; 828 Fidelity Phila. Trust Bldg., Philadelphia, Pa.; 1640-42 Conway Bldg., Chicago, Ill.; 514 Empire Bldg., Pittsburgh, Pa.; 1010 Hobart Bldg., San Francisco, Calif.

Gentlemen: Please send me FREE OF CHARGE your books as described above.

Name .....

Address .....

Shopping — American Style

IN MANY places abroad shopping is a matter not to be approached lightly. It takes time, and the ability to bargain, haggle and compromise. They *like* it!

In this country *advertising* has simplified the buying process. When you start out to shop in America you are conversant with quality, brands, values. The reliability of a well-known name is behind most of the things you buy—guaranteeing you satisfaction. And the price is the same to you as to everyone else!

Think of the time and trouble you save by reading the advertisements! How little thought and effort are required in the daily shopping! How well you can budget your expenditures! And how much delightful leisure this decreased shopping time affords you!

Take full advantage of the modern mode in buying. Read the advertisements every day. Have your mind well made up when you start out to shop.

Be Popular—learn to play a Pan-American!

A few easy lessons and you can play any Pan-American band instrument. Sure popularity and fun galore. Join the band and orchestra before Christmas.

Moderately Priced

Pan-American saxophones, clarinets, trumpets, trombones—all band instruments—are the only moderately priced, factory guaranteed instruments on the market. Write today for beautifully illustrated catalog. Send no money. Free trial. Easy Payments.

IT'S A PAN-AMERICAN

PAN-AMERICAN BAND INSTRUMENT & CASE CO.
1005-X Pan-American Bldg., Elkhart, Ind.

Magnified 225 Diameters

This is what the tip of a fly's leg is like when seen through the **Ultralens Microscope**

At last a high powered microscope is within the means of all who wish to study, observe and experiment with the vast world of minute objects invisible to the naked eye. Such fun it is, as well as educational. No technical training required, yet hundreds of scientists and teachers are using this instrument. Gives enormous magnification and perfect definition. Send $5.00 for complete outfit. Send for descriptive literature.

$5.00 for Complete Outfit Prepaid

ROAT & LOHMAN, Dept.203, Milton, Pennsylvania

be true, then whenever the violinist struck that particular note in his playing, it would be greatly amplified by the sympathetic vibration. Now this is not the case, for all notes from a violin are amplified alike. The explanation must lie in the nature of the walls that enclose this body of air."

He therefore encased a violin in a half-inch coat of cement, thus making its walls rigid. Presto, whenever a certain note was played, the sound was greatly amplified. While I was at his laboratory he had a clarinet player seat himself in front of this cement violin and play an ascending scale. When the note was reached which corresponded with the vibration rate of the violin's body of air, it sounded forth with several times the volume of the other notes in the scale. No such results occurred when a regular violin was used.

From all his analysis and experimentation Berliner finally reached the conclusion that where the walls are able to vibrate freely they prevent the enclosed body of air from developing a rhythm as a unit, thus eliminating reverberation and making the air-body neutral to all sounds. "There was nothing left then," explained Berliner, "but to invent some simple device that would cause the rigid brick or concrete walls of our modern halls to vibrate as freely as the walls of a violin, or the sounding board of a piano." The "acoustic cement cell," is the result.

The walls of his laboratory are brick. He struck a tuning fork and placed it against this wall. The sound could only faintly be heard. He held firmly against the wall an acoustic cement cell, struck the fork again, and then placed it on this device. Clear and amplified, the note sang out over the large room. His investigations led him to conclude that if even one-fourth of the wall area is thus made vibratory with these "cells" a wholly satisfactory acoustic effect can be had.

The old school of acoustic specialists—and there are a number of eminent men who have made this their life's study—look somewhat askance at Berliner's analysis of the principles involved. They have all built upon different premises—and have failed to solve the age-old problem.

But Berliner chuckled a little and observed that real progress comes only when somebody has originality enough to break with the orthodox ways of thinking. His mind runs back some 53 years to the time when his application of the principle of loose contact in the invention of the telephone transmitter violated a basic rule that had rigidly governed electrical work up to that time. And why shouldn't he have smiled? For though the skeptics may be able to argue plausibly against his logic, they are unable to refute the audible demonstration of his theory, as illustrated by the New York Cotton Exchange, the Drexel Institute Auditorium of Philadelphia, and other public halls.

Glider Builders!

If you have successfully built and flown a man-carrying glider, take some photos of it, and send them along with a description, to the Editor.

Noah's Ark Lives Again for the Movies

By Edwin Schallert

(*Continued from page* 503)

Lightning flashes and thunder rolls. The rain commences, first in a steady fall, and then in cloudbursts and torrents. The sea is churned into a frenzy by the wind. Great waves of water begin to dash over the land. The skies and the ocean unite their force, building up a gargantuan tide, which sweeps the earth. During various stages of the play, the toppling of the temple pillars and the crashing fall of the idol of Mammon are shown.

Details showing how the picture was made are shown in the accompanying illustration. The two main sets that were built comprised the tank and the interior of the temple. The tank was much larger than the type ordinarily used for such scenes, and consequently had to be specially built. It is made of concrete, and was equipped with several reservoirs, to be used for sluicing huge volumes of water into the scene. Wind machines were placed at numerous advantageous points to agitate the surface of the water, and hoses and rainfall pipes overhead were used to increase the impression of the inundation. Hundreds of men and dozens of horses struggled in the flood, or found momentary safety upon the "prop" rocks or portions of the reconstructed temple which were placed in the tank. To add to the flood, troughs and spillways were arranged at advantageous positions both in and around the tank. All views taken in the tank were supplemented with stock views of clouds and sky photographed on rainy days.

The temple set was over 100 feet long, and more than half that width. There were steps leading down into the sunken floor.

The climax of the flood is the complete destruction of the pagan city. The crowd rushing toward the camera was separately photographed and superimposed on this view of the miniature city and inundation.

The entrance of the animals into the ark is also visualized in the photoplay. One beholds them coming from all directions in a long shot in the film. In part this shot was miniature (background) and part real animals (foreground).

"Noah's Ark" as it was actually built for taking the motion picture of that name. Note the elephants in the foreground.

...IT CONTRIBUTES TO THE PROSPERITY OF THE PEOPLE AND TO THE COMFORT AND CONVENIENCE OF LIVING

The telephone grows with the country

An Advertisement of the American Telephone and Telegraph Company

THE Bell System must march a pace ahead of the new civilization on this continent, a civilization of better opportunity for the average man. The telephone contributes to the prosperity of the people and adds to the comfort and convenience of living.

It is used by the many. The time and money it saves are as important to the small business as to the large. The humblest home depends on it for aid in emergency, to run errands, maintain friendships. It is the aim of the Bell System to keep telephone service so good and so cheap that it will be used universally to make life richer and better. It seeks to lead the way in social and business growth. It is raising buildings this year in more than two hundred cities, adding vast mileage to the expanding network of cable, and installing new telephones by the hundreds of thousands.

It is spending more than 550 million dollars this year—one and one-half times the cost of the Panama Canal—for new plant and service improvements. This program is part of the telephone ideal that anyone, anywhere, shall be able to talk quickly and at reasonable cost with anyone, anywhere else. There is no standing still in the Bell System.

Earn More Money in California!

$40 to $75 a week for Auto Men

Don Sterling makes $75 a week, Victor Wright, $60 a week, Paul Briggs, $4000 a year—all because of National training. Big opportunities for you, too, in California. National will train you in a few weeks as auto mechanic, electrician salesmen, etc., to fill big pay jobs now open—$40 to $75 a week. Million dollar school established 1905, thousands of successful graduates. New method of practical shop training insures your success.

EARN WHILE YOU LEARN

Our free employment service finds you a spare-time job, if you wish. You can earn while you learn.

FREE Auto Book

FREE! Special $75 course in salesmanship and garage management, for limited time only. Mail postal or write for big free eighty-four page auto book, with 150 illustrations—gives all facts.

NATIONAL AUTOMOTIVE

Dept. 301-AE, 4004 South Figueroa Los Angeles, California

Latest Radio Guide FREE—Send for it now

Big Radio Guide shows how to assemble short wave, television and other radio apparatus, kits, sets, etc., for best results at startlingly low cost. Tells how A-C Screen Grid works. Shows you latest radio wrinkles—how to save money on tubes, supplies, etc. High Quality complete sets at wholesale prices. You need this book. Send for it NOW. It is free.

MAIL THIS COUPON FOR FREE COPY

Barawik Co., 339-A Canal Sta. Chicago, U. S. A.

Name .....

Address .....

City ..... State.....

Win $1000.00 CASH

This Offer Is Open to Every Reader of This Announcement

It makes no difference who you are or where you live we want you to send us a name for our toothpaste. Whoever sends the most suitable name will win—nothing more is necessary to gain this cash prize of $1000.00.

Nothing to Buy—Nothing to Sell

You can use a coined word or a word made by combining two or more words, such as "Snow-White," "Gum-Strength," etc., or any other name you might think would fit the high quality of this dental cream. There is nothing to buy or sell—simply the person sending the best and neatest suggestion for a name will receive $1000 cash prize, or, if prompt, $1100 in all.

ANY NAME MAY WIN

No matter how simple you think your suggestion is you cannot afford to neglect sending it at once. Any name may win.

NAME THIS

Win this $1000 cash prize by a few moments' thought. How can you earn this amount of money easier or more quickly? Remember, there is no obligation! The person submitting the winning name will have nothing else to do to win the $1000 and the extra $100, if prompt. In choosing a name bear in mind this dental cream is marvelous for teeth and gums. It is designed to sweeten the breath, beautify the teeth, cleanse cavities and promote teeth and gum health. The only thing necessary to win is to send the name we choose as the neatest and best suited for this dental cream. Only one name will be accepted from each contestant. This unusual offer is only one of a number of offers embraced in our novel distribution plan, whereby those taking part may win any one of twenty-odd prizes, the highest of which is $3500 cash. By participating in our distribution plan the winner of the $1100 cash prize may win an additional $3500, making a total of $4600. Everyone sending a name regardless of whether it wins or not, will be given the same opportunity to win the $3500 or one of the other cash prizes. Get busy with your suggestion at once—do not delay! Neglect may cost you thousands of dollars.

$100 Extra for Promptness

To get quick action I am going to pay the winner an extra $100 for promptness, or $1,100 in all—so send your suggestion AT ONCE!

CONTEST RULES

This contest is open to everyone except members of this firm, its employees and relatives.

Each contestant may send only one name. Sending two or more names will cause all names submitted by that person to be thrown out.

Contest closes November 30, 1929. Duplicate prizes will be given in case of ties.

To win the promptness prize of $100 extra, the winning name suggested must be mailed within three days after our announcement is read.

MR. H. E. RAY, *Contest Manager.*
707 McCune Bldg., Des Moines, Iowa.
Enclosed with this coupon on separate sheet is my suggestion for a name.

Date this announcement was read.....

Date my suggestion is mailed.....

Name.....

Address.....

NOTE: Being prompt qualifies you for the extra $100.00 as outlined in this announcement.

THOUSANDS OF MEN

will make fortunes in Aviation. Airplane Drafting and Designing are the biggest jobs ahead in this fastest growing industry. A new field of opportunity for you is opened in our improved method of training.

EASY TO LEARN. STUDY AT HOME. PAY AS YOU GO. EMPLOYMENT SERVICE.

Write for booklet outlining courses in Airplane Drafting, and other aviation subjects, including the famous Weems system of Navigation—endorsed by Col. Lindbergh, Commander Byrd, Lincoln Ellsworth, Admiral Moffett, etc.

Name .....

Address .....

City ..... State.....

☐ AIRPLANE DRAFTING
☐ AIRPLANE MOTORS ☐ AIRPLANE MECHANICS

PACIFIC TECHNICAL UNIVERSITY

250 POWER MICROSCOPE $16.50

MADE IN U.S.A.

Educational, entertaining, this fine microscope helps all to know life that can't be seen with unaided eye. Tiny insects look like monsters. Plant and mineral life reveal new wonders in form and color. Used by students, dentists, physicians, scientists—in home, office, school and laboratory. Precise optical qualities.

Magnifies 100 to 250 times. Tilting stand, fine finish, nickel trim, plush-lined case, prepared slide, instructions. At your dealer or direct postpaid. Money back guarantee. Other models $2.50 to $8.50.

Catalog Free

Wollensak Optical Company
877 Hudson Ave. Rochester, N. Y.

How to Have Talking Movies

(*Continued from page 522*)

Next arrange a method for putting your movie screen in front of your loud speaker. Having done this, you have merely to set the projector in position when you are ready to show your first "synchronized" films.

And now as to the actual filming and "synchronization." You have your choice of three kinds of sound effects, the first of which requires practically no preparation or apparatus other than that described above, with the exception of an appropriate phonograph record. One advantage of this method is that you can add a musical score or "theme-song" to any film you may now have, by merely playing the record chosen (*via* the pick-up) through the radio speaker, and at the same time projecting the film on the screen, which is in front of the speaker.

For example: in a love scene one might use "Kiss Me Again" or "I Can't Give You Anything But Love," or any one of a thousand records that seems to fit the occasion.

Suppose you have a Spanish picture. Music from "Carmen," such as the "Toreador Song" or "In a Little Spanish Town" might give just the proper touch.

A variation of this method is one that I tried when I first started experimenting with amateur talkies. I bought a wig and some grease paint, and having seen Al Jolson make up as a blackface comedian in his latest picture, I proceeded to make myself up to look as much like him as possible. After much rehearsal I put Mr. Jolson's record of the song "Sonny Boy" on the phonograph and sang the song in accompaniment with the words on the record, going through all the characteristic gestures and emotions. All this time I was being filmed. After the film had been printed, I projected it on the screen, and at the same time played the record through the radio amplifier. Approximate synchronization was easily obtained by adjusting the speed of the motor, and I had as realistic a talkie as any amateur could desire.

The second sound effect possible with this apparatus is that of straight talking. The simplest way of producing this is to prepare a short talk—a joke—a few introductory remarks of some kind—or what you will. Memorize this, word for word, and recite it slowly and distinctly before the camera.

When projecting the finished picture on the screen, simply repeat the words into your microphone, following the motions of your own lips, and voila—you have a talkie!

Of course, two or more persons may be in a film of this sort. If so, it is advisable, but not essential, that each one have a separate microphone in which to speak his part; unless a very sensitive one, similar to those used by broadcasting stations, is at hand.

The third method of applying sound effects to a film is a combination of the other two ways: namely, to have musical accompaniment and at especially dramatic moments to have the actors speak their parts, as is done in so many of the latest professional films. It is an easy matter to switch from voice to music or vice versa. When you wish to talk, merely close the microphone switch. If you are using a desk type telephone, just pick the receiver up in order to close the circuit. As soon as you have finished talking, the opening of the switch will automatically cut the pick-up into the circuit once again. This effect is possible because of the difference in the electrical resistance of the pick-up and the "mike." When the switch is closed most of the current goes through the latter, as electricity always favors the path of the least resistance. Upon opening the switch, the "mike" is no longer in parallel with the pick-up, so the current again flows through the pick-up.

Repairing Wooden Clock Works

(*Continued from page* 522)

A few pieces of cherry wood, a few pieces of wire, and a small piece of brass, and some twine, is practically all the material this clock movement was made of. It was made in Winchester, Connecticut, at the close of the eighteenth century. It was worked out patiently by hand with a pocket knife and a few crude country tools, and it was put together by the man who made it, a carpenter.

It was essential in those days to make a prospective customer depend upon a clock to tell time by; that was in those days a sort of first requisite. And there were others of the rugged farmers who had first to be shown that a "wooden mechanism" would actually work.

There was hardly any machinery used—in fact, none, almost to the close of the eighteenth century—in the making of these wooden movements. The cutting of the wheels and the pinions and all the "gears" was done with a crude saw and a jack-knife. These were usually marked out with a square and compass and then sawed out with as fine a saw as they could get or perhaps make for themselves.

To put in a tooth in a broken wheel or to repair a pinion where there are leaves broken out, it was always necessary to use some kind of hardwood—mahogany or oak. The writer preferred to use fibre for its flexibility; but he mended this clock more easily than many others, lesser repairs, by using plastic wood—wood in a can, in the form of a paste that can be moulded any way you want, as easy as putty, and which in a few hours hardens into wood.

IMPORTANT

TO NEWSSTAND READERS

IN order to eliminate all waste and unsold copies it has become necessary to supply newsstand dealers with the actual number of copies for which they have orders. This makes it advisable to place an order with your newsdealer, asking him to reserve a copy for you every month. Otherwise he will not be able to supply your copy. For your convenience, we are appending herewith a blank which we ask you to be good enough to fill in and hand to your newsdealer. He will then be in a position to supply copies to you regularly every month. If you are interested in reserving your copy every month, do not fail to sign this blank. It costs you nothing to do so.

.....

To.....Newsdealer

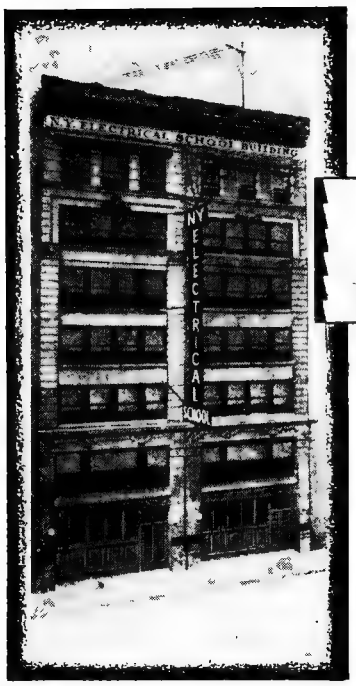
Address.....

Please reserve for me.....copies of SCIENCE AND INVENTION every month until I notify you otherwise, and greatly oblige,

Name.....

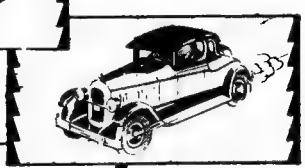
Address.....

"N.Y. ELECTRICAL SCHOOL" Men



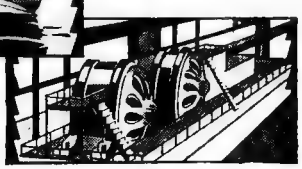
Graduate into many fields...

AVIATION ELECTRICITY



AUTOMOBILE ELECTRICITY

NAUTICAL ELECTRICITY



ELECTRICAL ENGINEERING

A full knowledge of electricity, as taught in the New York Electrical School, makes you independent, gives you your choice of either a BIG PAY job with one of the world-famous electrical companies, or a business of your own. ELECTRICITY is also a stepping-stone to Aviation, Automobile Engineering and other highly paid professions.

Here at the New York Electrical School you learn, not by correspondence, but by ACTUAL PRACTICE on full-size standard equipment. NO BOOKS used. Individual instruction—you can start any day. This School owns and occupies two seven-story buildings in New York—the city of most opportunities. It is widely known as the country's oldest and foremost institution for trade training. That's why big companies eagerly demand our graduates.

THE NEW YORK ELECTRICAL SCHOOL
29 West 17th Street, New York

FREE This big 64-page booklet gives full information about the New York Electrical School courses and picture of the equipment available for your personal use. Send for it TODAY. It's free.

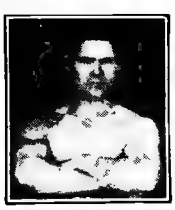
MAIL TODAY

The New York Electrical School
29 West 17th Street, New York

Please send me FREE your 64-page booklet. It is understood that this request puts me under no obligation.

Name .....

Address .....



Amazing Discovery

I positively guarantee to increase your arms one-half inch in size, chest one full inch, strength 25%, health 100% in one week's time by following my instructions and using my exerciser 10 minutes mornings and at night. Send $2 for complete course and exercisers. Satisfaction guaranteed or money refunded. Proof Free.

Prof. J. A. DRYER, Box 1850-L, Chicago, Ill.

SPRUCE STRIPS

All sizes and quantities
Perfect size and finish
Write us and save
RPLANE SPRUCE CO.
4046 N. Keystone Ave., Chicago, Ill.

VACUUM CLEANER MEN

Your selection of 30 leading makes, rightly rebuilt vacuum cleaners. From $5.00 up. All fully guaranteed. Perfect in action and appearance. Any quantity desired. Biggest vac bargain ever offered. Here's real money for you. ATTACHMENTS, bags, belts, brushes, all other parts, and new specialties. Highest quality. Lowest prices.

UNITED ENTERPRISES, Inc. FREE Complete Catalogs
World's Largest Factory Rebuilders
13028 Athens Ave., Cleveland, U. S. A.

Learn to PAINT SIGNS and SHOW CARDS

We quickly teach you by mail, or at school, in spare time. Enormous demand. Big future. Interesting work. Oldest and foremost school.

EARN $50 TO $200 WEEKLY

Otto Wiegand, Md., home-study graduate, made $12,000 from his business in one year. John Vassos, N. Y., gets $25 for a show card. Crawford, B. C., writes: "Earned $200 while taking course." Write for complete information.

DETROIT SCHOOL OF LETTERING
179 Stimson Ave. Est. 1899 DETROIT, MICH.

Be A Commercial Photographer

Earn $2,000 to $12,000 a Year!

THERE'S big money—fascinating work for YOU in commercial photography! Many photographers receive as much as $100-$250-$500 and even more for only one photograph. Photography today is one of the nation's most profitable professions—one that offers unequalled opportunities to the man or woman looking for interesting work, big pay and unlimited future.

It's All in Knowing How!

Now, at last, you can quickly qualify yourself for this well-paid profession, in which you come in daily contact with society people, prominent business executives, theatrical stars and athletic luminaries. Be your own boss or secure a well paid position. Many photographers have incomes ranging from $2,000 to $12,000 a year or more!

Success Is Within Your Grasp!

Now it is up to you—if you want your share of this lucrative profession! In your spare time at home you can master our entire course in modern photography. Many of our students earn many times their tuition fees even while learning. Thousands of men and women are winning quick success in commercial photography. One student, Michael Shuter of Brooklyn, N. Y., writes: "There is every indication that this time next year I shall reach the $10,000 mark." Commercial and News Photography; Portrait Photography; Lighting and Posing; Retouching; Enlarging; Finishing—these are but a few of the many fascinating branches of photography in which you are thoroughly trained by our simplified home study method.

FREE Book Gives Full Details!

Let us show you how in a few weeks you can qualify as an expert photographer and earn a large income. Send NOW for our BIG FREE BOOK giving full details.

YOUR SUCCESS COUPON

N. Y. Institute of Photography,
Dept. B-1814, 4 West 33rd St.,
New York, N. Y.

Please send me your FREE Book, "The Modern Art of Photography," and details as to how I can qualify as Commercial Photographer.

Name .....

Address .....

City..... State.....

EXTRAORDINARY VALUE!

KOLSTER
Electro Dynamic Reproducer

Combined with 210 Power Amplifier and "B" Supply Unit

Model K-5

This famous genuine Kolster K-5 AC Electro-Dynamic Reproducer is complete with a 210 Power Amplifier and "B" Supply Unit all self-contained on a steel frame. This real fine matched rugged Unit weighs 45 lbs. without the Cabinet. The Cabinet itself is Pencil-Striped Walnut, beautifully designed with Cathedral grille.

If desired, the 210 Power Amplifier will also supply 22, 67 and 90 volts "B" current, sufficient for any set using up to 8 tubes. An automatic voltage regulator tube, UX-874, maintains the "B" voltage silent and steady.

This Electro-Dynamic Reproducer can be used with any battery or AC set, replacing the last audio stage, or be used with all tubes of the set. Wherever used it will bring out every shading and range of tone; every note is reproduced with utmost faithfulness, pure and undistorted. It will modernize any radio receiver.

Uses 1—UX-210, 2—UX-281 and 1—UX-874 tubes.

A 20-ft. cable is included with each instrument. Operates direct from 50-60 cycle, 110-120 volt AC current.

Brand new in original factory cases and guaranteed. Every Reproducer is serial-numbered and has factory guarantee tag enclosed.

List Price $175.00
(without tubes)

Never Before $49.50

AMERICAN SALES CO., 19-21 Warren Street, New York City

Be a MEAT CUTTER

Your future assured; people must eat; make good wages at steady, easy work; get a store of your own; previous experience not necessary; don't get by—get ahead. Send for FREE book, "Big Pay the National Way," telling all about our Home-Instruction Course. Write Today.

National School of Meat Cutting, Inc.,
Dept. H Toledo, Ohio

Wrestling Book FREE

Learn to be an expert wrestler. Know scientific wrestling, self-defense and Jiu-Jitsu. Develop a splendid physique, and have perfect health. Join this popular school and learn by mail. The famous world's champions—the marvelous

Frank Gotch and Farmer Burns

offer you a wonderful opportunity. Wrestling is easily and quickly learned at home by mail. Men and boys write now for splendid free book. Learn all the science and tricks. Be able to handle big men with ease. Accept this wonderful offer NOW. Send for free book today, stating your age.

Farmer Burns School of Wrestling, 3797 Range Bldg., Omaha, Nebr.

LEARN CARTOONING

At Home—In Your Spare Time

The famous Picture Chart Method of teaching **original** drawing has opened the door of success for hundreds of beginners. Whether you think you have talent or not, send for sample chart to test your ability, and examples of the work of students earning from $50 to $300 per week. *Please state your age.*

THE LANDON SCHOOL
1460 National Bldg., Cleveland, O.

Learn Photography at HOME

Make money taking pictures. Prepare quickly during spare time. Also earn while you learn. No experience necessary. New easy method. Nothing else like it. Send at once for free book, *Opportunities in Modern Photography*, and full particulars.

AMERICAN SCHOOL OF PHOTOGRAPHY
Dept. 1427, 3601 Michigan Ave. Chicago, U. S. A.

When Fate Fooled Houdini

By Dunninger

(*Continued from page* 505)

audience as the mishap is immediately covered up in some fitting way or manner.

A Close Escape in Mid-Air

DURING the filming of the *"Grim Game,"* in which picture you will recollect Houdini jumps from one plane to the other, hundreds of feet in the air, to rescue the beautiful damsel from the clutches of the villain, the scene almost caused the master mystifier his life. No sooner had Houdini jumped from the plane which flew about twenty feet above the other one than the machine began to dip, something had gone wrong, and the top plane crashed down on top of the other one, which held the aviator, the leading woman and Houdini. Cameramen, actors and the director held their breaths. How was it going to end? Quick thinking cameramen continued to grind so a last-

Houdini, handcuffed behind his back, leaping into river; second photo shows him coming to the surface with the cuffs in his hand.

ing photographic record of that big moment was preserved. And thanks to the grit, quick thinking and steady nerve of the aviator, the actress and Houdini no one was injured, but all of them received the shock of their lives . . . except Houdini who was used to thrilling situations, for wasn't this sort of nerve-racking business part of his game? "It was a grim game, all right," said Houdini as he helped the rescue crew untangle the aviator and the actress when the planes reached the ground.

An adventurous soul was Houdini. He took chances no one else would. There is a story told of this master of thrills that took place while he was returning from Australia. The steamer was in the shark-infested waters near Suva, in the Fiji Islands. There is a supposition in those parts that sharks, no matter how deadly and ferocious, will not touch a black man. So runs the tale and through belief in this more or less foolish fancy, native men and boys, without a thought of fear, dive deep for the coins thrown into the water by tourists. Houdini stood against the deck rail with a number of other passengers and watched the antics

of the native divers. Noticeable among the divers was a young fellow who seemed to always come up out of the water with the coin, thrown by one of the men or women, in his mouth. Much talk was indulged in about this man's remarkable diving ability, but Houdini, who had been watching him closely for some time, declared that the man dove into the water, grasped the coin with his hand and then put it into his mouth. Others disputed this but Harry finally wagered that if the diver's hands were tied behind his back, which would not interfere with his diving, that he (the diver) could not catch the coin in his mouth as he was supposed to have been doing right along. Furthermore, Houdini would allow himself to be handcuffed and dive off the ship and would return with a coin in his mouth.

Members of Houdini's company didn't care to have an experiment of this kind take place, but the master of magic decided that what he said was to be so. And so it was. The captain warned Houdini to watch out for sharks, as they weren't exactly playful. The native diver was called aboard and an interpreter explained what he was to do. The black diver agreed.

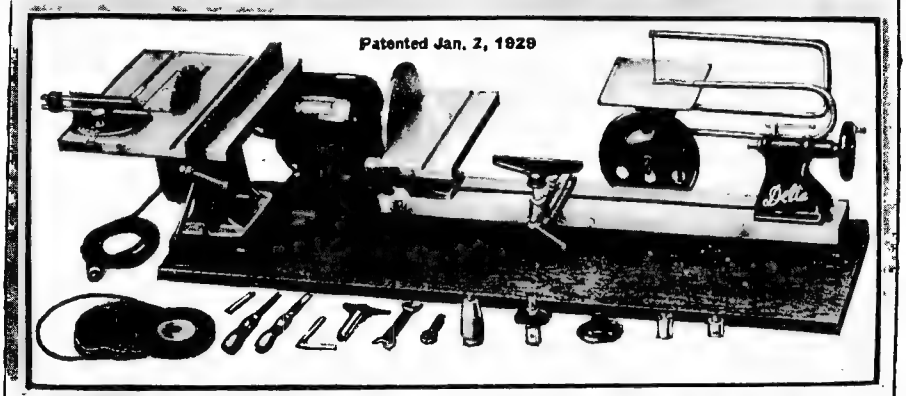
Houdini got into his bathing suit and brought from his stateroom a pair of handcuffs. The black fellow's hands were tied behind his back while Houdini was manacled. Two forms hit the water together after two coins were tossed overboard. A wait of a minute and the black's head appeared. He needed air. A half minute later, feet first, Houdini made his re-appearance. The diver didn't have his coin but Houdini had both the coins in his mouth. He won the bet but handed both the coins to the diver for his trouble.

"Did you see any sharks?" asked a passenger. "Didn't I heave into sight quick enough?" asked the handcuff king. "Yes, but why feet uppermost?" "Well, replied Houdini, "I was deep down under the water with one of my hands released. I grabbed both the coins and shot them into my mouth. It had to be done quickly because it would have been anything but pleasant to get a mouth full of that water. Then I spied a shark. It was a large, ferocious looking thing. So I shot myself upward with as much force as I could muster. But I remembered I didn't put the cuff back on my wrist so I shot around and came up feet first which gave me the required fraction of a second to readjust the cuff." "A great stunt," remarked a bystander. "Not at all," replied Houdini, "I did it because I wanted to have those Fiji Islanders know I was as good a swimmer as they!" "But the chance you took!" exclaimed another eyewitness. "My business is full of chances, and what would life be without its hundred and one thrills!" made answer the world-thriller—Houdini.

The Mystic Handcuffs

ONE afternoon Houdini, and myself were visiting a theatre owner of our acquaintance, when Harry brought out a pair of steel handcuffs and started to toy with them. Knowing he was up to some prank we called in the special officer on duty at the house. As he entered the room Harry made a pass at him and encircled his wrist with a handcuff, locking it as he did so. The officer was surprised for the moment but recognizing Houdini and ourselves, laughed and told the handcuff king he would now have to teach him the secret as to how he could release himself. Harry laughed and told him he'd call around some other day and see if he had gotten out. Suddenly the special officer somehow slipped the cuffs from his

MAKE THINGS *QUICKLY* and *EASILY* with this COMPLETE MOTORIZED WORKSHOP



The "Delta" Electric Handi Shop

Designed *for* Efficiency *in* Operation

Practical craftsmen appreciate this man-sized, motorized workshop with its carefully planned, efficient design. The "Delta" is equipped with a smooth-running, powerful, *two-shaft motor*. Permits carrying on two or three important operations at one time *without continually dismantling set-up*. Much-needed Circular Saw available 90% of the time! Also has heavy Triple Foundation Lathe Bed (no rods), guaranteed not to chatter; Improved Patented Tilting Tables on Circular Saw and Sanding Disc; Automatically Oiled Bronze Bearings. Comes completely assembled, thoroughly tested, on heavy veneered wooden base. Many new exclusive features in 1929 model—new low price.

Enjoy the thrill *of* Working with Quality Machinery

Make the things you have always wanted to make, with this sturdy, full-sized equipment. Save money on repair work—earn money in spare time. It is so easy—so quick, with the "Delta." Complete Handi-Shop includes all necessary equipment for Circular Sawing, Wood Turning, Scroll Sawing, Sanding, Drilling, Grinding and Buffing. Full instructions and complete set of working blue-prints furnished.

BLUE PRINTS INCLUDED
With each Handi-Shop, at no extra cost, is furnished a complete set of working drawings. Above are a few of the hundreds of useful articles you can make quickly and easily with this practical workshop.

Sent on 10 Days Trial Easy Terms

Without obligation, you can test the Handi-Shop under actual working conditions for 10 days in your own home. Send at once for FREE illustrated literature, giving complete description of the new 1929 Model "Delta" Handi-Shop, and full details of 10-Day Trial Offer and Easy Payment Plans. *Dept.* C-109

Delta Specialty Co.
1661-1667 HOLTON STREET
MILWAUKEE, WISCONSIN

Delta Specialty Company, Dept. C-109
1661-67 Holton St., Milwaukee, Wis.
Please send me, FREE, illustrated literature describing 1929 model "Delta" Handi-Shop. Also details of 10 Day Trial Offer and Easy Payment Plans

Name.....

Address.....

Now! Do Your Own Electric Nickel Plating

Introductory Offer ONLY $6.50 Plus Postage

Make $150 to $500 a Week

No experience required. Do YOUR OWN Electro-Plating in Your Home Garage, Office, or Place of Business. Electrically Deposit Metal—Nickel Brass, Copper, Silver or Gold. You can Successfully do all the plating on your Automobile, Electric Fixtures, Faucets, Spoons, Forks, Chandeliers, Tools, Coffee Urns, Surgical and Dental Instruments, Utensils large or small, Iron Stoves, Music Instruments; recondition worn plating or plate New Work; do it Instantly without interrupting the Service or without removing the parts to be plated with the

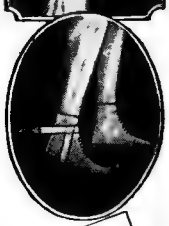
ALADDIN PORTABLE ELECTRO-PLATER

Simple and Economical to operate. Not a toy, but a practical Plating Outfit with which Perfect and Durable Work can be done. Positively Guaranteed to do as we claim. BE YOUR OWN BOSS! Build up a Profitable Aladdin Electro-Plating Business of your own. This offers wonderful ECONOMY to users and BIG MONEY-MAKING possibilities to AGENTS. Thousands in Service. Write for FREE Booklet and Testimonials and 30-Day Trial Offer Today. AGENTS and DEALERS WANTED EVERYWHERE.

Thousands in Service since 1924

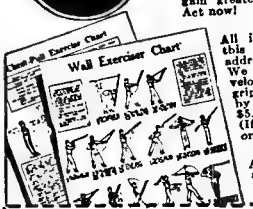
P. J. F. BATENBURG, Dept. 114, RACINE, WISC.

Get Strong WITH These Improved Muscle Builders All for $5.00



Why pay an extravagant price for strength—get all equipment you require and excellent course of instructions for only $5.00. Develop muscles of a super-man. Get strong and amaze friends. We show how to easily master feats which now seem difficult—if you want physical culture for your health's sake, this equipment is just what you need. Save at least half. We furnish a ten cable chest expander adjustable to resistance up to 200 lbs. Made of new, live, extra strength, springy rubber to assure long wear and give resistance you need for real muscle development. You also get a pair of patented hand gripe for developing powerful grip and forearms.

We include wall exercising parts which permits you to develop your back, arms and legs—a real muscle necessity. Business men and athletes, too, first are in their legs. Develop leg muscles with foot strap which we furnish. This will give you speed and endurance—but that isn't all you get. In addition we include a specially written course which contains pictures and diagrams showing how to develop any part of your body so you quickly get on with these exercises and gain greatest advantage from their use. Act now!



SEND NO MONEY

All items pictured are included in this special offer. Sign name and address to coupon and rush to us. We send your ten cable chest developer, wall parts, a pair of hand grips, foot strap and the course by return mail. Pay postman $5.00, plus postage on arrival. (If you send check or money order in advance, we pay postage.)

GUARANTEE

All Crusader products are guaranteed to give entire satisfaction or money back.

Crusader Apparatus Co.,
Dept. 410, 44 Parker Ave., Maplewood, N. J.

I accept your offer. Send me everything described in your advertisement by return mail. I will pay postman $5.00 plus postage on arrival. It is understood if I am not entirely satisfied after examination. I can return the goods and you will refund my money.

Name .....

Street .....

City ..... State .....

Learn... **Electricity**

Men Wanted

For World's Highest Paid Profession

YOU Earn $60 to $100 a Week Up—by this Guaranteed Actual Training Method!

Big-pay jobs now open for electricians everywhere. We train you for expert's pay with most complete course, in heart of electrical projects. National training has made thousands of men successful

Learn a fascinating, easy way—in laboratories and working on $250,000.00 worth of new equipment. Special Commercial Radio Course. Big electrical firms always want National-trained men. Write now for information about opportunities awaiting you here and

in California's Million-dollar Shops

FREE HANDBOOK

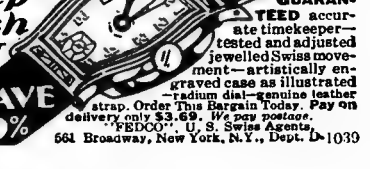
Tells you how to be a high-paid electrical expert quickly.

NATIONAL ELECTRICAL SCHOOL

NATIONAL ELECTRICAL SCHOOL
Dept. 301-EE, Figueroa & Santa Barbara Sts., Los Angeles, Cal.

FREE ELECTRICAL BOOK

Men's Strap Watch
LATEST MODEL



$3.69

A fully GUARANTEED accurate timekeeper—tested and adjusted jewelled Swiss movement—artistically engraved case as illustrated—radium dial—genuine leather strap. Order This Bargain Today. Pay on delivery only $3.69. We pay postage.

SAVE 50%

"FEDCO", U. S. Swiss Agents,
561 Broadway, New York, N.Y., Dept. D-1039

wrists and handed them to Houdini saying, "Here. Open them." Houdini took the key from his pocket and opened the cuffs.

Quick as a flash the special officer grabbed the key and the cuffs and slipped them on the manacle wizard's wrists, pressed them home and snapped the cuffs shut.

"And now that I have the key, let's see you get out of them, Mr. Houdini," laughed the officer.

"Place the key on top of that desk," indicated Houdini, "and I'll see what I can do."

No sooner said than done. The key was placed on the manager's desk and immediately Houdini turned around, tossed the cuffs on a typewriter desk and picked up the key.

To the consternation and surprise of us all the officer picked up the handcuffs and they had not been slipped from the wrists of Houdini, but had been unlocked!

I have time and again witnessed Houdini escape from packing cases and trunks in as short a time, as it takes me to read the mind of some skeptical fellow in the back row of the top gallery. I was also present at the wizard's water burial, in which he outdid the much-heralded fakir, who first introduced the stunt. I truthfully believe that had Harry Houdini listened to my plea not to attempt that foolhardy stunt, he would yet be mystifying folks with his own full-evening's performance. He was in none too good condition when he attempted the test as he was complaining, now and then, of a pain in his side.

Houdini had many imitators. There was never a tight corner that Houdini couldn't escape from, but his imitators weren't so successful. One in particular, I won't mention his name, remains vividly in my mind. This fellow was trying his best to out-Houdini Houdini. It was pitiful the extremes he went to in his effort to try and do this. One evening I witnessed his show and the funniest moment, yet most dramatic it was to myself as I knew what he was trying to do as well as knowing what might have happened, was when this copyist was trussed up in a fifty-foot length of rope from which he was unable to free himself.

I had gone up on the stage at the beginning of the act with a friend, to act as one of the committee, but had nothing to do with the actual tieing of the performer.

If it were possible for me to do it I would have helped the unlucky fellow out of his predicament, but I wouldn't have stood a chance with the other men, who had challenged him that night. I spoke to an assistant, "Cut him out." I whispered. The assistant disappeared around the back of the cabinet. Suddenly the would-be Houdini stepped from the cabinet free of the ropes. The escapeologist walked over toward me and said in guarded tones, which only my friend and I could hear, "Thanks, Dunninger! I'm glad you helped me by tipping off my man. I was in a devilish mess!" Next day I received by express the length of cut rope with a card reading: 'No more lies, no more ties; I'm going to do magic by and by!" And the card was signed by . . . well, he's a good magician too . . . . now!

Was Houdini ever stuck with a pair of handcuffs, was he ever fastened into any instrument of restraint, from which he failed to liberate himself? These questions have been asked by almost everyone who ever knew or came in contact with the wizard of escape. To those intimate

NIGHTS OF JOY IN STORE FOR You!

Free Lessons!

START TO PLAY VERY FIRST DAY

Even if you can't read a note of music right now, you play a simple melody on the very day you get your Deagan Xylorimba. Free, easy lessons show you how. Soon you are amazing friends and relatives. Then a new life begins—long, happy evenings of joy; parties; popularity; radio engagements—and the same chance to make $5 to $25 a night as Ralph Smith, Chicago—"Played 20 minutes at wedding; received $20." Or the Hallmann family, Reading, Pa.,—"Made $300 in 5 weeks, spare time."

FIVE DAYS' FREE TRIAL—Our big FREE book tells all about this fascinating instrument—the 5-day free trial offer—the free lessons—the easy payment plan. Send in the coupon today—the booklet will be mailed promptly without cost or obligation.

MAIL COUPON TODAY!

J. C. Deagan, Inc., Dept. 1567, 1770 Berteau Ave., Chicago

Send me, without obligation, full details of Free Trial offer and easy-payment plan on the Deagan Xylorimba.

Name .....

Address .....

High School Course in 2 Years

This simplified, complete High School Course—specially prepared for home study by leading professors—meets all requirements for entrance to college, business, and leading professions.

20 Other Courses

Over 200 noted Engineers, Business Men, and Educators helped prepare the special instruction which you need for success. No matter what your inclinations may be, you can't hope to succeed without specialized training. Let us give you the practical training you need.

American School
Drexel Ave. & 58th Street
Dept. H-753 Chicago

Money Back When You Finish If Not Satisfied

AMERICAN SCHOOL, Dept. H-753
Drexel Avenue and 58th St., Chicago

Send me full information on the subject checked and how you will help me win success in that line.

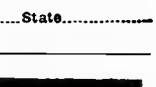
....Architect	....Electrical Engineer
....Building Contractor	....General Education
....Automobile Engineer	....Lawyer
....Civil Engineer	....Mach. Shop Practice
....Structural Engineer	....Mechanical Engineer
....Business Manager	....Steam Engineer
....C. P. A. & Auditor	....Draftsman & Designer
....Bookkeeper	....High School Graduate

Name..... Age.....

St. and No.....

Town..... State.....

Learn AVIATION
WHERE LINDBERGH STARTED!



GET TRAINING THAT ASSURES SUCCESS!

Come to Lincoln—one of the largest, best-known and finest-equipped civilian aviation schools in this country. We trained Lindbergh (our FREE Literature tells the story). Complete, practical courses in flying, aircraft building, airplane mechanics, welding and aerial radio. *Instructors and training plans approved by the Aeronautical Division of the U. S. Dept. of Commerce.* Write for FREE Literature today!

LINCOLN AIRPLANE SCHOOL
224 Aircraft Bldg. Lincoln, Nebr.

with Houdini, would come a thought of an experience which he often related. It happened in London, England. *The Daily Illustrated Mirror,* an English paper of prominence, had challenged Houdini to escape from a pair of handcuffs, which had been made by a Birmingham blacksmith, and which, it was said, had taken five years to perfect. Houdini had accepted the challenge, and a committee representing the newspaper brought the cuff to the handcuff manipulator, upon the stage of the London Hippodrome, where an audience of over four thousand people awaited the much heralded event. Both the pressmen and Houdini asked friends to step upon the stage, to form a committee to see that fair play predominated.

Those of my readers who witnessed the work of Houdini in any of the theatres throughout the nation, will undoubtedly recall the speed and ease with which he would free himself from all kinds of manacles. Ten or twelve handcuffs would be locked upon his arms at the same time. Houdini would kneel on the floor, and a small cabinet would be placed over him. The curtain would be drawn so as to conceal his hands, but not his face. Usually, it would take the escape wizard about two minutes to free himself from all of the irons.

But upon this fatal night, fate had decided differently. After the lone pair of irons securely embraced the wrists of Houdini, he retired into this cabinet, or little *ghost house,* as he called it, leaving his committee anxiously awaiting results. Gracefully, the clock of time ticked on. Five minutes passed . . . then ten . . . fifteen and twenty. . . . The audience anxiously awaited results. Finally, Houdini's head peeped from out the ghost house. "He is free" shouted many in the audience. They were, however, sadly disappointed. Houdini, still handcuffed, merely examined the locks beneath the glare of the footlights. With saddened face, he re-entered the cabinet. Heavy perspiration trickled from his face. He seemed worried, worn and uncomfortable. He asked that a pillow be placed beneath his knees, as they were beginning to hurt. The request was granted by consent of the newspaper's representative. Twenty minutes more elapsed . . . the orchestra played on, and once more, Houdini emerged from the cabinet. He was still handcuffed. Approaching his challenger, he asked that the cuffs be removed for a moment, so as to enable him to remove his coat. This the journalist refused to do, stating that he would not unlock the cuffs, unless Houdini would admit defeat. He explained that Houdini had seen the cuffs locked, but had never examined them unlocked. Consequently, he thought that his reason for refusal was obvious.

Houdini became somewhat angry. He maneuvered until he succeeded in removing a penknife from his pocket. This he succeeded in opening with his teeth, and turning his coat inside out, he proceeded to cut the coat into pieces. Houdini once more entered the cabinet. Time sped on, and presently the timekeeper announced that Houdini had been in his cabinet, and unsuccessful in liberating himself, for one full hour! Ten minutes more of anxious waiting . . . and out came Houdini, holding the shining handcuffs in his hands. One hour and ten minutes had the wizard of escape nervously labored with one lone handcuff. The strain had been so great, and his disappointment in the length of time that he had labored, so keen, that he burst into tears. Houdini did succeed, but he had been stuck . . . and badly, too, and he never forgot this episode.

(Watch for the next article in the December issue.)

Money Making Tools

Sent to YOU Become a BIG PAY MAN with My Help

ALSO DRAFTING TABLE

COMPLETE OUTFIT

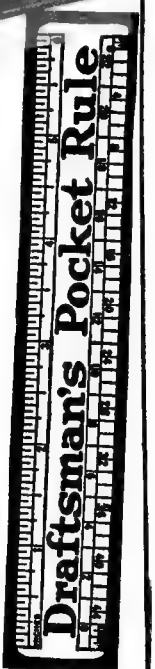
ALL are Regular Draftsman's Tools SENT AT ONCE

Earn as You Learn

I tell you how to start earning extra money a few weeks after beginning my training.

Copy me and get Ivorine Rule Free.—Jack

Copy this Jack and Get this Draftsman's Rule FREE



Automobiles—Electricity—Motor Busses—Aviation—Building Construction.
There are jobs for Draftsmen in all of these industries and in hundreds of others.
Aviation is expanding to enormous proportions.
Electricity is getting bigger every day.
Motor Bus Building is becoming a leading world industry.
Building of stores, homes, factories and office buildings is going on all the time.
No structure can be erected without plans drawn by a draftsman. No machinery can be built without plans drawn by a draftsman.
I train you at home, in Drafting. Keep the job you have now while learning drafting.
I will train you in drafting right where you are in your spare time. I have trained men who are making from $3,500 to $9,000 a year. There is a big future for draftsmen because you plan and supervise the work of others, or you go into business for yourself. Get started now toward a better position, paying a good, straight salary, the year around. Comfortable surroundings. Inside work.

Employment Service After training you I help you to get a job without charging you a cent for this service. Employers of Draftsmen come to me for men because they know that Dobe Trained Men make good as they have learned drafting by actually doing the work themselves, in a practical way. Employers know they are not taking chances on men trained by me.

Money-Back Agreement
I train you at home under a positive Money-Back Agreement. If my training does not satisfy you after you have finished, you get every penny back.

Age or Lack of Education No Drawback
Previous experience is not necessary. You do not need to be a college man or high school graduate.

Get My Pay-Raising Plan —also FREE

If you will mail sketch at once I'll send you also FREE "My Pay-Raising Plan"

I'll train you at home. —Engineer Dobe

If You Earn Less Than $70 a Week—Write Me Today!

Mail this coupon, at once with copy of Jack. Get "My Pay Raising Plan" and "Successful Draftsmanship". Both of them point the way to Success. You owe it to yourself to find out what a big opportunity there is in practically all industries, for Draftsmen. These two books are Free. They come to you post-paid. Mail the Coupon for them TODAY.

Engineer Dobe, 1951 Lawrence Ave. Div. 14-27, Chicago

MONEY-MAKING TOOLS COUPON

ENGINEER DOBE, 1951 Lawrence Ave., Div. 14-27, Chicago

Here's my copy of Jack. Send me free of all cost your book, "Successful Draftsmanship", also plan to earn money while learning and proof of big money paying positions. Also your new book "My Pay-Raising Plan." Also tell me about your Money-Making Tools which you furnish. Send the free Pocket Rule.

Name..... Age.....

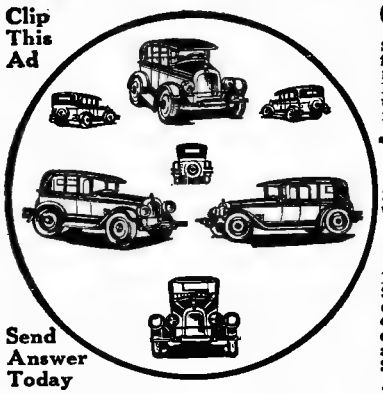
Address.....

Post Office..... State.....

Win a Nash Sedan

Or $2,750.00 in Cash

Clip This Ad



Send Answer Today

Someone who answers this ad will receive, absolutely free, a fully equipped 7-Passenger, Advanced Six Nash Sedan, or its full value in cash ($2,000.00). We are also giving away a Dodge Sedan, a Brunswick Phonograph and many other valuable prizes—besides Hundreds of Dollars in Cash. This offer is open to anyone living in the U. S. A. outside of Chicago.

Solve this Puzzle

There are 7 cars in the circle. By drawing 3 straight lines you can put each one in a space by itself. It may mean winning a prize if you send me your answer right away.

$750.00 Extra for Promptness

In addition to the many valuable prizes and Hundreds of Dollars in Cash, we are also giving a Special Prize of $750.00 in Cash for Promptness. First prize winner will receive $2,750.00 in cash, or the Nash Sedan and $750.00 in cash. In case of ties duplicate prizes will be awarded each one tying. Solve the puzzle right away and send me your answer together with your name and address plainly written. $4,500.00 in prizes—EVERYBODY REWARDED.

John T. Adams, Mgr., Dept. 3797, 323 S. Peoria St., Chicago, Ill.

Print Your Own Cards, Stationery, Circulars, Advertising, etc. Save money. Print for others, big profit. Junior Press, $5.90. Job press $11 up. Rotary $149. Easy rules sent. Send for catalog presses, type paper etc. THE KELSEY CO., S-47, Meriden, Conn.

SQUAB BOOK FREE

Breed squabs and make money. Sold by millions. Write at once for free 48-page book beautifully printed in colors telling how to do it. You will be surprised. PLYMOUTH ROCK SQUAB CO., 506 H St., Melrose Highlands, Mass.

Fix that Car

Learn How Easily

JIFFY INDEX In These Five New Big Auto Books Makes All Facts Instantly Available. Find Anything You Want to Know in a Moment in This Latest Edition

All Shipped FREE

5 Big Auto Books

Repair any auto fault, learn how now. You can do it easily in this new simple way. These five big automobile books are the most interesting, the most practical books we have ever published on automobile construction, operation and repairs. Brimful of facts, photographs and explanations so easy to understand that anyone can learn how to repair auto faults in almost no time. Over 2,000 pages full of diagrams, data sheets and everything else needed to make anyone an authority on automobiles. Whether you want to qualify as garage owner, auto repair expert or merely wish to know how to keep your own car 100% efficient, you will recognize the amazing value of these five big books, especially on our

No Money Offer

A very liberal plan of distribution brings these books to you for examination without one cent of payment to us. We don't ask a cent of you, but ship the books free. Look them over, read them as much as you want to, note the splendid photographs and drawings, and then if you decide you want them, send only $2.00 and then $3.00 a month until only $24.80 is paid. That is all. Nothing more to pay us. There is no further obligation.

American Technical Society Membership Free

Yes, we include a certificate of membership in the American Technical Society, which entitles you to free consultation with 18 experts for one year on any subject relating to automobile engineering. You can write or wire any time for special information. Answers will be sent promptly without cost.

Repair Any Auto Fault

With these books you don't have to worry about auto troubles. Illustrations are so clear and explanations are so simple that anyone can understand them. All phases of automobile engineering fully covered.

Find Facts Quickly

One of the best things about these money making books is the Jiffy Index, which puts vital facts at your finger tips. You don't have to read the books through; you don't have to spend long hours over them. This Index enables you to put your finger on the information wanted in a jiffy.

Don't Hesitate

There are no strings to this offer – it means just what it says. Send name and address on the coupon and all of the five big books will be sent you. Remember, one fact alone may save you an expensive repair or help you to a better job.

American Technical Society, Dept. A-725
Drexel Ave. at 58th St., Chicago, Ill.

I would like to look at the five big auto books—send them on your free offer. I will pay the few cents delivery charges. If I like them I will send you $2.00 when I have had the books fifteen days, and then $3.00 a month until the special low price of only $24.80 is paid. Otherwise I will return the books at your expense. You are to include, without charge, free consulting membership certificate in the American Technical Society.

Name .....

Address .....

Employer's Name .....

Employer's Address .....

BIG-PAY JOBS in ELECTRICITY

$60.00 to $150.00 WEEKLY

Amazing new method. Trains you quicker and better. Motion Pictures in your own home make every point clear. Genuine DeVry motion picture projector at no extra cost. Thousands of feet of film furnished. We pledge to give you training and employment service necessary to secure a better job at bigger pay or refund money. Get full facts. No obligation. Write quick while offer lasts.

Motion Pictures Train You QUICK

National School of Visual Education. Dept. 10-N
537 S. Dearborn St., Chicago, Ill.

Send book, "The Film Way to Bigger Pay," with facts about this new, easier way to master electricity.

Name.....Age.....

St. or R. F. D.....

City.....

State.....

MAIL THIS COUPON NOW!

Making an Air Lift Pump

By L. B. Robbins

(*Continued from page* 524)

combined area should equal the cross section area of the pipe itself—about ½ sq. inch. Below these slits drill two holes through the pipe at right angles to each other and drive through two steel pins slightly less in length than the diameter of the eduction pipe. These act as spreaders to prevent the air pipe from blowing into one side of the larger pipe. Do not make them so long, however, that they will jam when lowering or raising the air pipe in or out of the eduction pipe. When this is completed, lower it down into the eduction pipe and thread on more lengths until the cap strikes the bottom of the strainer. Then measure carefully and cut off the air pipe and run on a thread at least 6 in. long so it can be threaded up through the top section of the flange coupling and project an inch or two above it when seated. With that done let the coupling sections come together and bolt them in place to make an air and water-tight joint.

Then pipe the ¾ in. pipe to the outlet of the air pressure tank with an elbow and valve as shown, using ¾ in. pipe for the purpose.

The pressure tank can be purchased for the purpose or can be made from a hot water heating expansion tank or even a hot water boiler. The two latter, however, should be tested for pressure and any chancy ones discarded. Whatever style of pressure tank is used, it should be supplied with a pressure gauge and a safety valve which can be purchased from any steam supply company. The diagram shows the method of piping.

The Compressor

IF it is deemed advisable to make your own air compressor it can be accomplished with an old stationary or motorcycle engine as suggested.

The engine can be a small one and no alterations need to be made except the following: Remove the carburetor and intake pipe and leave the intake port open. All external cams, etc., can be removed if the intake valve is spring actuated. If not, the cam operating that valve will need to be left in operating order. Close up the exhaust port by either bolting a metal plate and gasket across the opening in the cylinder block or clamping the valve in its seat. Then tap a ¾ in. pipe into the spark-plug opening and lead to the tank or, if the firing is done by make and break, remove the exhaust valve and tap the bearing for the ¾ in. pipe. The user will have to work out his own methods due to the variety of engines that may be used for this purpose, but the idea is to close the exhaust and keep the intake working; also to use the exhaust valve opening or the spark-plug port for the supply pipe to the tank. Now, to make compression greater, drill and tap two holes in the piston head and bolt on a circular piece of metal thick enough to make the compression chamber very small when the piston is at the end of the compression stroke. Tight rings should also be placed on the piston. Place a check valve in the pipe line to the tank so no back air pressure will return to the compressor.

The Drive

AS suggested, a small gas engine can be used to run the compressor or an electric motor if you are lucky enough to have electric current. Use a ratio of pulleys so the compressor will turn over at maximum speed and see that the belt is tight to

Become a Member of the JUNIOR RADIO GUILD

and Receive Your Introductory Lesson FREE!

In just a few short weeks you can build your own radio set, make sets for your friends at a big profit, and become an authority on radio for your whole neighborhood.

It's lots of fun, too, when you learn through the Junior Radio Guild, because you actually build sets as you learn. And there is practically no hard study, because we tell you all about radio in simple, easy words that even a baby could understand.

Over 12,000 boys are already members of this great organization sponsored by RADIO NEWS, and they have told so many of their friends about what wonders it has done for them, that membership is increasing rapidly.

BIG MONEY If You Learn Now!

All you have to do to become a member of the Junior Radio Guild, absolutely FREE, is to mail us the coupon below. The 25c we ask for is merely to cover the cost of the beautiful bronze membership pin and your membership card. You receive your introductory lesson absolutely FREE!

Mail the Coupon Today!

JUNIOR RADIO GUILD, Dept. 2510u
381 Fourth Avenue, New York, N. Y.

Gentlemen:

Please enroll me as a member of the JUNIOR RADIO GUILD. I enclose 25c (coin or stamps) to cover the cost of my membership pin and membership card. I also understand that I will get the introductory lesson in Radio Instruction for Boys FREE by return mail.

Name.....

Address.....

City.....State.....

avoid slipping as the load becomes quite heavy when considerable pressure has accumulated in the tank.

A small one-horse power engine built over in this manner should be able to create all the air pressure necessary. A regular air compressor can be purchased, of course, if desired but is not necessary if this idea is resorted to. Now, with the engine running and the compressor filling the air tank, you are ready to raise water.

Operating

TURN on the valve at the well-head slowly. This will admit pressure through the nozzle slits into the water of the well. The natural outlet for the water thus put under pressure will be up through the eduction pipe. As it rises, more will rush in to take its place and, with a constant stream of air flowing into the bottom of the pipe under sufficient pressure the water will gradually rise until it flows into the tank above ground. A little experimenting will soon determine the proper pressure to admit to get the best flow of water. The valve can then be marked for the number of turns necessary to open so the right working pressure can always be released into the foot piece.

Do not be surprised if air rises with the water as that will be perfectly natural under the circumstances. The great beauty of such a system is that there are no working parts to become filled with silt or foreign matter. This will all be forced to the surface and hence it would be wise to put a strainer in the supply tank outlet to prevent any dirt from entering the water system in the house. When necessary the water pressure can be released by means of the drain cock in the well-head as described.

In RADIO NEWS for October

POWER SUPPLY AND AMPLIFIER FOR THE RADIO NEWS FOUNDATION TUNER—A compact and easily constructed unit which furnishes filament and plate voltages and grid bias voltages for the Foundation Tuner (described in RADIO NEWS for September) and embodies a push-pull output employing type '45 tubes. An input transformer, for use with a phonograph pickup, is also provided.

COMPLETE STATION CALL LIST—A revised call list of all the broadcast stations of the United States and Canada, alphabetically by call letters, and by wavelengths; list of foreign broadcast stations; list of short-wave stations of the world.

A SUPER DX RECEIVER—The "Magister" Tuner, designed particularly for efficient long-distance reception, employing six a. c. screen-grid tubes and one type '27; the last-named as oscillator. A superheterodyne receiver to gladden the heart of the home constructor who has not lost his love for the real DX.

WHY THE DYNAMIC SPEAKER?—A comparison of various types of loud speakers, and their respective efficiencies, showing why the dynamic cone is today in the ascendant.

THE PERSONALITY BEHIND THE GHOST HOUR—Some highlights on the career of Dunninger, who has been using radio to reach a wider audience, in carrying on the late Harry Houdini's work of "de-bunking" spiritualism.

NOW I will train YOU for BIG PAY in ELECTRICITY

Station WISN operates from S. of E. Also amateur Station W9SO.

OSCAR WERWATH
Electrical Engineer
Pioneer in Electrical Training for 25 years.

RIGHT IN YOUR OWN HOME!
Just As I Have Trained Over 25,000 Graduates In My Great ELECTRICAL SCHOOL!

BIG HOME LABORATORY Without Extra Cost

Full-sized laboratory equipment (Not toys) that you can't duplicate for $60.

SPECIAL PATENTED Laboratory Equipment

that cannot be secured elsewhere. Makes fascinating sport of laboratory experiments. Amazingly easy to use.

LEARN BY DOING

Work on actual motor, switchboard, circuits, and full-sized electrical equipment. Get Training that is PRACTICAL.

NOW, through my Extension Division, I will train you for advancement and MORE PAY in Electricity without your leaving your home! You will get the same course, the same methods, the same faculty of skilled engineers that have made The School of Engineering internationally famous.

Behind your training will be an institution specializing in Electricity—a fully established college, recognized by the U. S. Gov't. Thousands of S. of E. graduates now employed in important positions with largest concerns in the country.

ELECTRICALLY TRAINED MEN Earn $3,000 to $10,000 a Year

In Radio, Television, Aviation, Automotives, Refrigeration, Moving Pictures, Super-Power, Lighting—Electricity is the key. Big manufacturers are pleading for men trained in **Practical Electricity.** Salaries of **$3,000 to $10,000** a year now are common. Here is a vast field for you, with unlimited opportunities. **Now** is the time. Start on the road of Electrical Training that leads to bigger pay—bigger opportunities—and SUCCESS!

EARN AS YOU LEARN

Cash in on your Electrical Training while you're learning. Many students report increased earnings, advancement, even while studying. Train in your spare time at home. Employment Service renders FREE aid for life. Lifetime Consultation Service. Many exclusive features available nowhere else. Mail the coupon today for full particulars.

FREE!

Send Coupon TODAY for illustrated Catalog—"Practical Electricity—the Key to Success"—and full details of Extension Division Training.

MAIL COUPON NOW!

Extension Division, Dept. 21
SCHOOL OF ENGINEERING
Milwaukee, Wisconsin

Please send me without obligation FREE illustrated catalog, "Practical Electricity—the Key to Success," and details of Extension Division training.

Name .....

Address .....

.....

EXTENSION DIVISION
SCHOOL OF ENGINEERING
Dept. 21 Milwaukee, Wis.

Money Making Opportunities

I'll Start You Without a Dollar. You'll make $85 weekly, taking orders for finest shirts, ties. Free Outfit. Dept. PC 10, Rosecliff, 1237 Broadway, N.Y.

Big Money Maker Tailoring Line. Pays $4 to $7 an order. Quality Suits, Topcoats, Overcoats. Free suits to producers. Giant outfit free. Dept. PC-10, Olympic, 5th Avenue, cor. 19th Street, New York.

A Paying Position Open to Repr. of character. Take orders Shoes-Hosiery direct to wearer. Good Income. Permanent. Book "Getting Ahead" Free. Tanners Shoe Mfg. Co. 21410 C St. Boston.

Agents sell personal Christmas Cards. Full comm. in advance. We deliver and collect. Samples Free. Hill Studio, 272 Lafayette St., New York.

Agents earn big money taking orders beautiful Dress Goods, Silks, Wash Fabrics, Hosiery, Fancy Goods. 1000 samples furnished. National Importing Co., Dept. W89, 573 Broadway, N.Y.

Sell Washable Uniforms to Doctors, Dentists, Nurses, Barbers, Hotels, Restaurants, Druggists, etc. Delivery charges prepaid. Write today. Dura-Style, 304 N. 15th Street, St. Louis.

Big Pay Daily, Selling Shirts, Pants, Overalls, Sweaters, Leather Coats, Lumberjacks, Underwear, Hosiery, Playsuits! Outfit Free. Nimrod Co., Dept. 85, 4922-28 Lincoln Ave., Chicago.

$5.00 Every Time You Sell My Tailored-to-Order $35.00 value All-Wool Suit for $23.50. If you want to try—write! Everything Furnished Free. P. A. Bobb, 2256 S. La Salle, Chicago.

$2.95 Autoseat Covers -Cash Daily- Amazing all America-Postcard brings Leatherette Sales Outfit. "Quality," 515 So. Dearborn, Dept. PCS, Chicago.

$8.00 Daily showing friends, neighbors our all-wool made-to-measure clothes $23.75. Everything furnished Free. Your profit in advance. Write Fairbanks, 2308 Wabansia, Chicago.

Without one cent investment make $65.00 every week selling finest work pants made. Every man buys 3 pair for $5.50. Outfit Free. Dept. L.C.S. 10, Longwear, 489 Broome St., New York.

Make Big Money. Sell shirts and ties. Tailored broadcloth, 3 for $6.95, commission $1.50. Beautiful Rayon lined ties. Outfit Free. Dept. BCS 10. Big Bob, 489 Broome St., New York.

Agents Wanted to introduce fast-selling personal necessity and distribute free samples. $1.25 an hour easy. Al. Mills, 3787 Monmouth, Cincinnati, O.

Free Suits earned by 48 men plus cash profits of $75.00 to $425.00. Nationally known line. Great Western Tailoring Co., Dept. 306, Chicago.

We Start You Without a Dollar. Soaps, Extracts, Perfumes, Toilet Goods. Experience unnecessary. Carnation Co., Dept. 670, St. Louis, Mo.

Women 18 to 45 wanting to increase their income. Pleasant work. Will not interfere with present duties. Write Brown Co., Dept. 1A, Paducah, Ky.

W't'd immediately. Men-Women. 18-55, qualify for Gov't jobs; $125-$250 mth. Paid vacations. Thousands needed. Instruction Bureau, 137, St. Louis.

Punchboard Salesmen. $10,000 yearly. New Line. Lowest prices. Full commission. Catalog Free. Puritan Novelty Co.; 1405 Jackson, Chicago.

A Business of Your Own. Bankrupt and Bargain Sales. Big Profits. We start you, furnishing everything. Distributors, Dept. 279, 429 W. Superior, Chicago.

$5 Hourly easy selling famous ex-clusive novelties. Shirts--Ties--Underwear. Full or part time. Outfit free. Dept. 134-Q, Vanderbilt Mills, 29 W. 32nd St.; New York, N. Y.

Hotels Need Trained Executives—Nationwide demand for trained men and women; past experience unnecessary. We train you by mail and put you in touch with big opportunities. Write at once for particulars. Lewis Hotel Training Schools, Room BS-W637, Washington, D. C.

America's Greatest Tailoring Line free; 200 samples; guaranteed pure virgin wool; tailored to order; low price; big commissions daily; also cash bonus; get outfit at once. Address Dept. 210, Goodwear, 844 Adams, Chicago.

Earn $100 Weekly Selling Banks, business, professional and society people. America's greatest Xmas Greeting Cards. Large cash commissions daily, liberal monthly bonus and samples together with full instructions sent Free. If you want to earn $2,000 before Xmas apply now to Mgr., Dept. M-2, Process Corporation, Troy at 21st, Chicago.

You Can Make Big Money In The Food Business. No capital or experience needed; credit given. Here is your chance to establish a permanent business of your own in exclusive territory. We furnish Free Sample Case and Free Samples for customers. Repeat orders every week. Ask now! Federal Pure Food Co., W2311 Archer, Chicago, Ill.

Hosiery Agents—Take orders for startling new hose. Absolutely no competition. Not sold through stores. Every woman buys. Big repeater. Outfit Free! Racine Feet Knitting Co., Dept. 40-10, Beloit, Wis.

I'LL PAY YOU $20 A DAY

To Show My Mystery Lighter to Men. What Makes It Light? All Guaranteed. Sample With Sales Plan 25c. Sample Gold or Silver Plated, $1.00. Agents write for proposition.
NEW METHOD MFG. CO.
Desk S.I.-10 Bradford, Pa.

I CHALLENGE

you that I will teach you, by mail, in one lesson, the simplest, shortest method. Not telepathy. You can read one's mind to a dot, by only looking in the eyes of partner, chum, sweetheart, etc. All for $1.00. Praised by New York, Boston, Montreal Police chiefs; colleges; Thurston; Blackstone, etc. If fake, let them arrest me.

A. HONIGMAN, Dept. INV. 7
Sta. E., P. O. B. 85 Montreal, Can.

"He saves $100 a month"

"See that man at the receiving teller's window? That's 'Billy' King, Sales Manager for The Browning Company. Every month he comes in and adds $100 to his savings account.

"Three years ago he started at Browning's at $25 a week. Married, had one child, couldn't save a cent. One day he came in here desperate—wanted to borrow a hundred dollars—wife was sick.

"I said, 'Billy, if you'll follow my advice I'll let you have the hundred. Take up a course with the International Correspondence Schools and put in some of your evenings getting special training.'

"That very night Billy wrote to Scranton. In a few months he had doubled his salary! Next thing I knew he was put in charge of his department and two months ago they made him Sales Manager. It just shows what a man can do in a little spare time."

Employers are begging for men with ambition—men who really want to get ahead in the world and are willing to prove it by training themselves in spare time to do some one thing well.

Prove that you are that kind of man! The International Correspondence Schools are ready and anxious to help you prepare for something better if you will only make the start. Do it now! At least find out what the I. C. S. can do for you. Mail the coupon today!

INTERNATIONAL CORRESPONDENCE SCHOOLS
"The Universal University"
Box 6199-F, Scranton, Penna.

Without cost or obligation on my part, please send me a copy of your 48-page booklet, **"Who Wins and Why,"** and tell me how I can qualify for the position, or in the subject, *before* which I have marked an X:

TECHNICAL AND INDUSTRIAL COURSES

☐ Architect
☐ Architectural Draftsman
☐ Building Foreman
☐ Concrete Builder
☐ Contractor and Builder
☐ Structural Draftsman
☐ Structural Engineer
☐ Electrical Engineer
☐ Electrical Contractor
☐ Electric Wiring
☐ Electric Lighting
☐ Electric Car Running
☐ Telegraph Engineer
☐ Telephone Work
☐ Mechanical Engineer
☐ Mechanical Draftsman
☐ Machine Shop Practice
☐ Toolmaker
☐ Patternmaker
☐ Civil Engineer
☐ Surveying and Mapping
☐ Bridge Engineer
☐ Gas Engine Operating
☐ Automobile Work
☐ Aviation Engines
☐ Plumber and Steam Fitter
☐ Plumbing Inspector
☐ Foreman Plumber
☐ Heating and Ventilation
☐ Sheet-Metal Worker
☐ Steam Engineer
☐ Marine Engineer
☐ Refrigeration Engineer
☐ R. R. Positions
☐ Highway Engineer
☐ Chemistry
☐ Pharmacy
☐ Coal Mining Engineer
☐ Navigation ☐ Assayer
☐ Iron and Steel Worker
☐ Textile Overseer or Supt.
☐ Cotton Manufacturing
☐ Woolen Manufacturing
☐ Agriculture ☐ Fruit Growing
☐ Poultry Farming
☐ Mathematics ☐ Radio

BUSINESS TRAINING COURSES

☐ Business Management
☐ Industrial Management
☐ Personnel Management
☐ Traffic Management
☐ Accounting and C. P. A. Coaching
☐ Cost Accounting
☐ Bookkeeping
☐ Secretarial Work
☐ Spanish ☐ French
☐ Salesmanship
☐ Advertising
☐ Business Correspondence
☐ Show Card and Sign Lettering
☐ Stenography and Typing
☐ English
☐ Civil Service
☐ Railway Mail Clerk
☐ Mail Carrier
☐ Grade School Subjects
☐ High School Subjects
☐ Illustrating ☐ Cartooning
☐ Lumber Dealer

Name.....
Street
Address.....
City..... State.....
Occupation.....

If you reside in Canada, send this coupon to the International Correspondence Schools Canadian, Limited, Montreal, Canada

LEARN TELEGRAPHY WITH TELEPLEX

Be an expert Morse or Continental code operator! BIG PAY—TRAVEL — FUN — ADVENTURE. After a few short weeks of practical study with Teleplex you will be an expert operator. This amazing instrument teaches you right in your own home. Works like a phonograph. No knowledge needed—beginners learn at once! NOT A SCHOOL. Free 10 days' trial. Write for FREE booklet K-11.

TELEPLEX CO., 72 Cortlandt Street, New York City

AVIATION Information FREE

Send us your name and address for full information regarding the Aviation and Airplane business. Find out about the many great opportunities now open and how we prepare you at home, during spare time, to qualify. Our new book "Opportunities in the Airplane Industry" also sent free if you answer at once.

AMERICAN SCHOOL OF AVIATION
Dept. 1427 3601 Michigan Ave. CHICAGO

New Nine Tube A. C. Receiver

(*Continued from page* 535)

in this particular speaker instead of paper, and a closed center replaces the open center fiber construction. Flexible velvet is used for the outer suspension. The speaker is an entirely new development.

In the circuit diagram figure 1, is the hum control for the UY-227 tube. This is a twenty-ohm resistor. Figure 2 is the pilot lamp; 3, is the motor plug; 4, line supply plug, and 5 is the hum control for the UX-226 tube in the first audio stage which is a twenty-ohm resistor. Figure 6, is the transfer switch which makes it possible to change from the radio to the phonograph. Figure 7, is the record volume control, a 500-ohm resistor. Figure 8, is the tone control which is a one-megohm resistor. The power switch is shown at 9.

An induction disc motor and a 12-inch turntable are placed in the top portion of the cabinet. A new electric pick-up is used and is mounted on the end of a straight pick-up arm which replaces the usual tone-arm. By the turn of a switch it is possible to change from radio phonograph reproduction in a second's time. The phonograph records are reproduced through the audio end of the radio receiver as shown in the circuit diagram. The instrument will operate from 105 to 120 volt, 50 to 60 cycle alternating current lines and special equipment is available for operation on 105 to 120 volt, 25 to 40 cycle alternating current supply.

Engineering Taught by Movies

(*Continued from page* 492)

transformer. By means of these animated movies, the building up and the collapse of the lines of magnetic force in the field of a transformer or a motor are clearly shown in such a way that the student will never forget the action so illustrated in picture form before his eyes. The direction of an electric current in a certain circuit is indicated very clearly.

$5,000 FOR PERPETUAL MOTION

The editors have received thousands of different designs of perpetual motion devices, and have received hundreds of circular letters soliciting finances for the building of perpetual motion machines.

The editors know that if they receive these letters, there are thousands of others in this country who get similar letters and who fall for the claims made in the numerous prospectuses giving the earning capacities of the various machines.

Most of the shares of stock for these perpetual motion machines are being sold at a rate of $1.00 per share, although some inventors are trying to sell shares of stock at $100.00 per share.

Therefore, the editors of this publication say, "Just come in and show us—merely SHOW us—a working model of a perpetual motion machine and we will give you $5,000.00. But the machine must not be made to operate by tides, winds, waterpower, natural evaporation or humidity. It must be perpetual motion."

Pay as You Please

Select your own payment terms for a Mead instrument. Make money playing in local orchestras. Be the "life" of the party wherever you go. 10 DAYS FREE TRIAL—no obligation to buy and no cost to you. Mead instruments are easy to play and a joy to learn. If you can hum a tune, you can play. Free instruction book—new simple method. Send a postcard today for free instrument catalog with marvelous offers and terms.

Mead CYCLE CO.
DEPT 246-M CHICAGO

We Pay YOU Big Money for Your Spare Time

Do easy, interesting work in your home town. We pay big money for your spare time. Pays just as well at night as it does during the day. Many of our staff have earned as high as $35.00 a week extra in their spare time by just following our simple instructions.

No Experience or Capital Necessary

Anybody can make big money with us. You don't need to be brilliant or talented. There is nothing difficult to learn, and we supply all the material for beginning at no cost to you whatsoever. You can start without a cent in your pocket and earn $5 the very first day.

Begin Earning at Once

Fill out and mail us the coupon below, and next week you can have plenty of extra money. Write us now! We want to tell you all about it.

Mackinnon-Fly Publications, Inc.,
Dept. 2510-w, 381 Fourth Ave.,
New York City

$ $

Mackinnon-Fly Publications, Inc.
Dept. 2510-w, 381 Fourth Ave.,
New York City

Gentlemen:
Please tell me how I can easily earn BIG MONEY in my spare time without investing a penny.

Name.....
Street.....
City.....State.....

MODEL BLUEPRINTS

Correct—Easy to Follow

1–2	Horizontal Steam Engine details.....set	$1.00
3–4	Boiler construction for above .....set	$1.00
5	880 Ton Bark.....	50c
6–7	Twin Cylinder Steam Engine and Boiler.set	$1.00
8–9	Gasoline Fired Locomotive .....set	$2.00
10–11	U. S. S. Constitution, "Old Ironsides"..set	$1.00
12	13th Century Man-of-War	50c
13–14	Chinese Junk.....set	50c
15–16	Electrically driven Automobile .....set	$1.00
17–18	How to Build a Reflecting Telescope...	$1.00
19	Roman Ballista.....	50c
20–21	Simple Steam Engine, set	50c
22	"Santa Maria," complete	50c
23–24	Model U. S. S. Portsmouth .....set	$1.00
25	Building a Model Tugboat	50c
26	Twin Cylinder Marine Engine	50c
27–31	U. S. S. Truxton.....	$2.00
32	Sopwith Biplane.....	50c
33	Speed Boat.....	50c
34	Airplane Engine.....	50c
35–36	Motor Winch.....	75c
37–38	Vertical Steam Engine	$1.00
39	Cannon	50c
40	Steam Roller.....	50c
41	Prairie Schooner.....	50c
	Lincoln Sport Monoplane (man-carrying)	$6.75
	Gerber Monoplane (man-carrying)	$1.00

Send Orders to

BLUEPRINT DEPARTMENT
SCIENCE AND INVENTION
381 Fourth Avenue
New York City

What Our Readers Think

(*Continued from page* 533)

run next year myself, but if my saw had not been dull and some of the teeth out, I could have qualified for one this year or something just as good.

A college education is the most wonderful gift a father and mother can give a child. I could spend time writing whole pages upon the good my High School and one year at Indiana University have done for me. Everyone who succeeds must have a college education or its equivalent. The equivalent is the hard and stony path. A college education gives one a trained mind. The education I have had has enabled me to fit in anywhere and everywhere at this country club, to adjust myself to all situations—to meet people and please them, to work with the help in the kitchen, to make every motion count. To work, work, work with my hands and at the same time anticipate with my brain the next step. You can get there if you persevere, college education or no college education; you can also go to South America by going to Canada and Europe first. Why not take the direct route?

MRS. B. H. FREELAND.
120 E. 2nd St., Peru, Indiana.

(Perhaps some girl who has made good without a college education, will now write us and tell us how she overcame the handicaps possessed by the college educated girl. We admire Mrs. Freeland's willingness to help. We feel sure that any woman with as much spunk will succeed. The spirit "I'll make good in spite of all," is of keener metal than any "saw with broken teeth" and has the peculiar property of becoming sharper with use.

We wish you, and others who think as you and carry their thoughts into action, much good luck. You have our every wish for success.—EDITOR.

OIL BURNERS!

What do you know about them? In the next issue—Don't miss the article on oil burners for home furnaces, written by an expert.

RED BUG RACER WINS

KLAXON HORN
GOOD BRAKES
PLENTY OF SPEED

Here you are boys and girls! It's just what you have been waiting for. The RED BUG RACER—a real auto for young folks. A real classy, electric roadster that has plenty of speed and will do almost anything a big car can. Strongly built—Klaxon horn—electric lights, good brakes. Nothing to get out of order. Drive dad to work, run mother's errands and be the idol of your town with a RED BUG RACER.

FREE TO BOYS AND GIRLS

I am going to give away a limited number of RED BUG RACERS to boys and girls who write me quick. You may get one *absolutely free* and FREIGHT PAID to your home. I do not want one cent of your money—just a little of your spare time before or after school. Be first in your neighborhood to get a RED BUG. Write TODAY—QUICK. Just say, "I want a Red Bug Racer."

RED BUG BOY, BOX 3791, BATAVIA, ILL.

"how can I get into Aviation?

Read this Answer from

A World Famous Trans-Atlantic Pilot

AVIATION is waiting for no one! Landing fields, plane and equipment factories, air lines, service and sales organizations—all are leaping ahead in the most amazing development any industry has ever known. In such racing, feverish activity, *where* is there any room for a man who has nothing to offer? An empty pocketbook is no drawback—but Aviation has no place, no patience, no *time* for empty hands or empty heads! Aviation is taking-off for the greatest non-stop flight in history—and the men who will go along and climb to the top are the men with a foundation of FACTS under them.

You Don't Have to Fly; 40 Jobs on the Ground PAY BIG Too!

To succeed in aviation—make BIG MONEY—you need not necessarily be a pilot. There must be many thousands of pilots, certainly. But for every plane that flies, there's an immediate need for trained men in more than **forty** different important jobs on the ground. Construction, motor and instrument experts—airport managers, service foremen, salesmen—and more, all make **real** money. But every last one of them must have the FACTS. Today's problem—YOUR problem—is to LEARN Aviation **quick.**

WALTER HINTON

was pilot of the famous NC-4, first plane to fly the Atlantic. He piloted the first plane from North to South America. He was first to fly to the headwaters of the Amazon. And Hinton also has the rare ability to teach **others** the knowledge he has gained. During the War he was a crack flying instructor for the Navy. Today—with a course that experts agree is the most complete and practical ever produced—Hinton is training keen-sighted men for the Big-Pay jobs in Aviation.

Get Your Ground Work NOW at Home—Hinton Will Train You

YOU can train at home in spare time. Hinton's proved course gives you all the facts about construction, motors, instruments, theory of flight, navigation, commercial Aviation—facts that every man must have to intelligently and profitably fill ANY job in the industry. Serious-minded **air-minded**—men are reading and **acting** on the Free Book shown below. We want YOU to have a copy too! Send the coupon NOW.

Aviation Institute of U. S. A.
WALTER HINTON, *President*
1115 Connecticut Avenue Washington, D. C.

You Must Be 18 or Over
To take an active part in Aviation you must be at least 18 years of age. If you are under 18, please do not ask for Lieut. Hinton's Book because it will not interest you.

Get Hinton's FREE BOOK

Send to Washington—Quick

4-Z

WALTER HINTON, President
Aviation Institute of U. S. A.
1115 Connecticut Ave., Washington, D. C.

Please send me at once your FREE Book, "Wings of Opportunity," showing how I can get into this tremendous field.

Name .....

Street ..... Age .....
(Must be over 18)

City ..... State .....

A Bigger Job— *and You're the Man*

Are you hunting a bigger job, or does the bigger job hunt you? Why waste priceless years at routine work, when you can acquire at home in a comparatively few months the specialized knowledge for which big firms pay big money? Thousands of men have greatly increased their incomes by home-study business training under the LaSalle Problem Method. Let us show you how you can do just as well or better. The coupon will bring you complete information, together with details of our *convenient payment plan;* also your free copy of a remarkable book—"Ten Years' Promotion in One." Make your start toward that bigger job *today.*

—— —*Find Yourself Through LaSalle!*— —— —

LA SALLE EXTENSION UNIVERSITY
The World's Largest Business Training Institution

Dept. 10384-R, Chicago

Tell me about your *salary-increasing plan* for my advancement in the business field checked. Send also copy of "Ten Years' Promotion in One," all without obligation.

- ☐ Business Management
- ☐ Modern Salesmanship
- ☐ Higher Accountancy
- ☐ Traffic Management
- ☐ Railway Station Mgmt
- ☐ Railway Accounting
- ☐ Law—Degree of LL.B.
- ☐ Commercial Law
- ☐ Industrial Management
- ☐ Banking and Finance
- ☐ Modern Business Correspondence
- ☐ Modern Foremanship
- ☐ Personnel Management
- ☐ Expert Bookkeeping
- ☐ C. P. A. Coaching
- ☐ Business English
- ☐ Commercial Spanish
- ☐ Effective Speaking
- ☐ Stenotypy
- ☐ Telegraphy
- ☐ Credit and Collection Correspondence

Name .....

Present Position .....

Address .....

ELECTRIFY YOUR RADIO FOR ONLY $6.85 COMPLETE

Why discard your present good set when you can electrify it for only $6.85, and banish the annoyance and expense of buying new "B" batteries?

OVER 100,000 TOWNSEND "B" POWER UNITS IN USE

Hooked up in a few minutes. Use same tubes—no changes. You'll be amazed at the improvement in reception and distance getting. Send name and address today for full details, proof and Free Trial Offer.

TOWNSEND LABORATORIES,
725 Townsend St., Chicago, Ill.

Please send me full information on the Townsend "B" Power and Free Trial Offer.

Name .....

Address .....

City ..... State .....

Start to Play Very First Day

Be the life of the party. Xylorimbists make $5 to $25 a night. No knowledge of music required. Wonderful for home. Free, easy lessons; five days' trial; a year to pay. Send Coupon for BIG FREE BOOK!

YOU CAN PLAY THE XYLORIMBA

J. C. Deagan, Inc., Dept. 1567-B, 1770 Berteau Ave., Chicago
Send me, without obligation, full details of Free Trial offer and easy-payment plan on the Deagan Xylorimba.

Name _____

Address _____

To be sure of getting your copy each month, subscribe to SCIENCE AND INVENTION, $2.50 a year, Experimenter Publications, Inc., 381 Fourth Avenue, New York City.

Answers to Scientific Puzzles

(*Continued from page* 500)

Balancing a Bat

If a baseball bat is balanced on a knife-edge, it will be found that the greater proportion of the bat will be on the thick end. But while the weight is unequally divided the moment, or leverage of both portions is the same. This is because the heavier portion is closer, on the average, to the pivot, whereas the lighter portion is farther away.

Half Covering the Objective of a Telescope

Covering a portion of the objective of a telescope will not restrict the field of vision because each part of the lens focusses all of the light that passes through it and each part receives light from all parts of the object. The image that we see is formed from the overlapping images formed by all of the separate parts of the lens. The only effect that is noticed, consequently, is a diminution in intensity of the image.

The Sliding Weights

According to Newton's laws of motion a body will accelerate in proportion to the applied force and inversely as the mass accelerated. Since the masses accelerated are 30 lbs. in both systems it follows that the acceleration of the systems is proportional to the applied force. In one case this is 20 lbs. and in the other 10 lbs. Hence the first system will accelerate twice as fast as the second.

When we consider the tensions in the cords we find that this is the force required to accelerate the bodies moving horizontally. The tension in one case accelerates a 10 lb. mass just half as fast as the tension in the other system accelerates a 20 lb. mass. Since the product of the masses and their respective accelerations is the same it is evident that the tensions producing these accelerations must be the same.

Moist Air, Dry Air and Air Pressure

It is common knowledge that a low barometer usually precedes foul weather and a high barometer precedes and accompanies fair weather. This indicates that moist air is actually lighter than dry air, other conditions being the same. The explanation of this is that as moisture enters the air it displaces other components, notably oxygen and nitrogen. Now an oxygen molecule is nearly as heavy as a water molecule and a molecule of nitrogen is a little less than one of oxygen in weight. Consequently an increase in water vapor means a decrease in density of the air, whereas a decrease in water vapor is accompanied by a return of the heavier components and therefore an increase in density. Moist air is lighter than dry air.

Icebergs Salty?

Icebergs are not salty. In the first place they are formed originally from glaciers that slide down into the ocean and break off in huge pieces. Glaciers are formed from snow, falling on elevations from the sea. In the second place, icebergs are not salty because when salt water freezes it is only the water that freezes out from a dilute solution such as we find in the ocean. If the ocean were saturated with salt the salt and ice might

NEW LOW PRICES ON GOODYEAR Firestone FISK AND OTHER U.S. TIRES

Lowest Prices in History! This big company, because of its immense buying power, will supply you with reconstructed standard make tires at these unheard of low prices—whole year's service guaranteed. Thousands of satisfied customers reorder year after year.

12 MONTHS SERVICE GUARANTEED

ORDER NOW - SAVE MONEY

REGULAR CORD PRICES

Dealers Wanted	Size	Tires	Tubes	Size	Tires	Tubes
	30x3	$2.20	$1.00	33x5	$3.60	$1.75
	30x3½	2.25	1.00	35x5	4.45	1.75
	32x3½	2.70	1.15	BALLOON TIRES		
	31x4	2.95	1.15	Size	Tires	Tubes
	32x4	2.95	1.15	29x4.40	$2.30	$1.10
	33x4	2.95	1.15	30x4.95	2.90	1.35
	34x4	3.50	1.15	30x5.25	2.95	1.35
	32x4½	3.20	1.45	31x5.25	3.20	1.35
	33x4½	3.20	1.45	30x5.77	3.20	1.40
	34x4½	3.45	1.45	32x6.00	3.20	1.45
	30x5	3.60	1.75	All Balloon Sizes		

Send only $1.00 deposit with each tire ordered, balance C.O.D. If you send cash in full, deduct 5%. You are guaranteed a year's service or replacement at half price. MIDLAND TIRE AND RUBBER COMPANY
Dept. 128, 1000 West Sixty-third St., Chicago, Ill.

Add $150 to $300 Monthly PROFIT

Johnson added $125 monthly with 8-Hour Battery Charging. Wayne's Test Bench brought him $275 month. Bruce doubled battery sales with HB Tester. No investment required as fraction of profits paid for equipment.

Only $16 Monthly

Try HB 30 days at our risk on absolute money back guarantee. Also make Air Compressors, Car Washers and Paint Sprays—all money makers for you. Underline the item you are interested in and mail for full particulars without obligation to

HOBART BROS.
Box S-109 TROY, OHIO

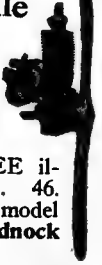
Choice of 1200 Newest RADIO VALUES

SEND for our 1930 catalog. Filled with amazing values in screen grid radios, push pull audio, consoles, kits, parts. All standard makes and guaranteed merchandise.

FREE

WESTERN RADIO MFG. CO.
128 W. LAKE ST. CHICAGO ILL.

Real Gas Engine Flies Model Airplane 1 Mile



At last! A practical engine (not an experiment) has been perfected to fly model airplanes. Develops ½ h. p. Will also run small rowboat or light motorcycle.

FREE Send at once for FREE illustrated Bulletin No. 46. Special discount to schools and model clubs. **Dynamic Mfg. Co., Monadnock Bldg., Dept. 103, Chicago.**

BASHFUL?

"Shame on you!" Are you nervous, embarrassed in company of the other sex? Stop being shy of strangers. Conquer the terrible fear of your superiors. Be cheerful and confident of your future! Your faults easily overcome so you can enjoy life to the fullest. **Send 25c. for this amazing book.**

RICHARD BLACKSTONE
BX-28 Flatiron Bldg. New York

MARVELOUS *NEW* PATENTED SCREW-HOLDING SCREW DRIVER

Non-magnetic. Holds screws tight! Removes them INSTANTLY from inaccessible places. Factories, radio, electricians, machinists, etc., buy on sight! Indispensable. Price $1.50 only. (Sent postpaid receipt money order.)

DISTRIBUTORS: Genuine opportunity earn big money. Exclusive territory. Write or wire quick for full details.

JIFFY-TITE MFG. CO. 1209 Water St. Boston, Mass.

$25.00 Drawing Course for $2.98

Haven't you often wished that you could draw cartoons, illustrate some idea, sketch some pretty face, etc.? You can do all of these things. One of America's most famous Cartoonists and Illustrators has developed a great, simple system for success in all branches of Commercial Art. This system has revolutionized the entire theory of drawing. It means that drawing can be as easy for you as writing—much simpler than learning shorthand, bookkeeping or typewriting. We are now placing this original system for learning Drawing, Art and Cartooning, consisting of 34 lessons with over 500 illustrations, within reach of every one. If you will devote a few hours each week to the Course WE ABSOLUTELY GUARANTEE that you will learn to draw and draw well before you have half finished the Course. If we fail to make this claim good we will refund every cent paid us. By eliminating a large office force for answering correspondence, expensive catalogs, etc., we are enabled to make a price of $2.98 the cheapest price ever known for a high-grade home study course. Many have sent us letters similar to that of Rob't. P. Davis of Detroit, who wrote: "I can't see how you ask so little, when others with inferior Courses get from $20 to $60 for theirs. It is more than I expected." Learn to draw. It is a big asset, no matter what field you are in.

Send No Money

Just order the Course, and on arrival pay postman $2.98 plus a few cents postage payment in full for the entire Course and Free Drawing Outfit. If not entirely satisfied, return within five days and we will REFUND MONEY. Address:

FREE If you order the Course at once we will include a drawing outfit, consisting of artist's pencils, pens, paper, erasers, thumb tacks, etc., enabling you to go to work without any additional cost.

LEDERER SCHOOL OF DRAWING, Dept. 912-P Chattanooga, Tenn.

Orders from outside the U. S. A. are payable $3.28 cash with order.

Any Size STANDARD $1 TIRES

DON'T MISS THIS $1.00 SALE

With each tire purchased we'll send another tire same size for only $1. Thousands of customers year after year order our specially selected, Harco treated, slightly used Goodyear—Fisk—U. S.—Firestone and other Standard tires—Because they get

Good MILEAGE and GUARANTEE

8 Months' Service or Replaced at ½ Price

Size	New tire	1 tire	2 tires	tube	Size	New tire	1 tire	2 tires	tube
30x3	$3.69	$4.69	$1.00		33x5	$7.45	$8.45	$1.75	
30x3½	3.69	4.69	1.00		35x5	7.45	8.45	1.75	
32x3½	3.95	4.95	1.05		29x4.40	3.69	4.69	1.00	
31x4	5.95	6.95	1.25		29x4.75	4.90	5.90	1.10	
32x4	5.95	6.95	1.25		30x4.50	4.90	5.90	1.25	
33x4	5.95	6.95	1.25		31x4.95	6.90	7.90	1.25	
34x4	5.95	6.95	1.25		30x5.25	6.90	7.90	1.25	
32x4½	6.95	7.95	1.50		31x5.25	6.90	7.90	1.25	
33x4½	6.95	7.95	1.50		30x5.77	6.90	7.90	1.50	
34x4½	6.95	7.95	1.50		33x6.00	6.90	7.90	1.50	
30x5	6.95	7.95	1.50						

8 MO. GUARANTEE OR REPLACED HALF PRICE

Send only $1 deposit on each tire to defray charges, balance C.O.D. 5 per cent off cash with order. Our reputation and guarantee protects you. Order today! Dealers Wanted. Get attractive proposition!

Hart Tire Co. 54th & Ashland Ave. Dept. 3410, Chicago, Ill.

WANTED MEN

To Manufacture Metal Toys and Novelties

Big demand for Toy Soldiers, Animals, 5 and 10c Store Novelties, Ashtrays, etc. We co-operate in selling goods you make, also buy them from you. Small investment needed to start and we help you build up. WE FURNISH COMPLETE OUTFITS and start you in well paying business. Absolutely NO EXPERIENCE and no special place needed. A chance of a lifetime for man with small capital. CHRISTMAS RUSH is now starting, so if you mean strictly business write AT ONCE for full information.

METAL CAST PRODUCTS COMPANY
DEPT. E 1696 Boston Road New York City

DOUBLE ACTION AUTOMATIC

Pull the Trigger— Out Pops a Cigarette

Patented $1.79

Protect yourself against hold-up, rowdies, etc. with this clever cigarette case of light weight metal. **Looks like genuine automatic!** Pull the trigger and out **shoots a cigarette** through the muzzle. Holds nearly a full pack of cigarettes. Handsome gun metal finish. **Double action.** Lots of fun scaring friends and a great protection. Order one to-day. When your friends ask for a cigarette, shoot one to them and enjoy a big laugh. Either enclose money order for $1.79 or **pay postman** $1.79, plus postage on arrival. **Money back if not satisfied.**

PATHFINDER CO., Dept. 1010, 200 Hudson St., New York

FREE Wholesale Radio Catalog

Set Builders-Dealers! Save Money!

Send for the most complete book of nationally known Parts, Kits, Cabinets, Consoles, Speakers, Power Units, Sets, etc. All at lowest wholesale prices. Quick service on all your needs. Write now, it is FREE—

SHURE BROS. CO.
Dept. 324, 335 W. Madison St., CHICAGO, ILL.

freeze out together at a low temperature far from the sea.

Balancing the Teeter-toter

To balance the teeter-toter the square of Lettie's weight must exactly equal the sum of the squares of the weights of the other two girls. The problem, then, is to find two whole numbers the sum of whose squares will equal 102 squared. A straightforward tho somewhat tedious way to do this is as follows. Double the number (i.e. 102) Subtract one and to this number add a number that is two less than what you got after subtracting one. Then add a number that is two less than what you added before and keep on in this manner until the last number that you have added is 1. Now look over the series for perfect squares and all numbers found to be perfect squares will be solutions of the problem. In this case there is only one solution as the only perfect squares that appear in the series are 2304, 8100, and 10404. Thus we see that the weights of the other two girls must be 48 and 90 lbs. respectively. The beginning of the series that leads to the solution is as follows:

102 × 2=204 and 204 — 1=203
203
201

404
199

603
197

800
etc.

Winding Watches

If a watch is wound at night the subsequent cooling may cause the spring to contract enough to damage it. Many people wind their watches too tightly anyway and any additional tightening due to contraction makes it worse. If the watch is wound in the morning the warmth of the owners body or the heat of the day will cause the spring to expand a little and thus relieve instead of increase the tension.

Negative Plates Get Hot

The negative plates of a lead storage battery get very hot if removed from the acid and allowed to stand in the air. This is because the spongy lead of which the plates are made is, in its moist state, in excellent condition to unite with oxygen from the air. This chemical reaction is a form of combustion just as the union of carbon with oxygen to form carbon dioxide is a form of combustion. The lead plates literally "burn up."

Sport Plane Blueprints Available at Nominal Cost

¶ Complete Set of Blueprints of Lincoln Sport Plane, $6.75.

¶ Gerber Monoplane—set of Blueprints, $1.00.

Send Orders to Blueprint Dept.

SCIENCE AND INVENTION
381 Fourth Avenue
New York City

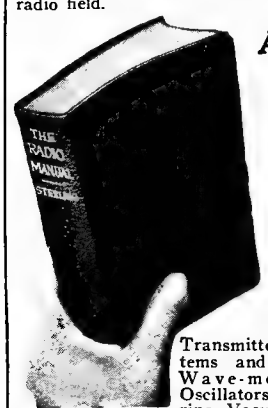
A NEW Edition

Thoroughly revised — greatly enlarged and offering a wealth of new up-to-the-minute information.

THE RADIO MANUAL

Revised Edition

Complete new chapters on aircraft radio equipment; Practical Television and Radiomovies with instructions for building a complete outfit; radio interference; 100% modulation; latest equipment of the Western Electric Co.; the Marconi Auto-Alarm System; and many other developments of the past year. All this information is added in the new edition and, besides, the entire book has been brought right up to date with much new material. *The Radio Manual* continues to be the one complete and up-to-the-minute handbook covering the entire radio field.



A Complete Course in a Single Volume

20 big chapters cover: Elementary Electricity and Magnetism; Motors and Generators; Storage Batteries and Charging Circuits; The Vacuum Tube; Circuits Employed in Vacuum Tube Transmitters; Modulating Systems and 100% Modulation; Wave-meters; Piezo-Electric Oscillators; Wave Traps; Marine Vacuum Tube Transmitters; Radio Broadcasting Equipment; Arc Transmitters; Spark Transmitters; Commercial Radio Receivers; Marconi Auto-Alarm; Radio Beacons and Direction Finders; Aircraft Radio Equipment; Practical Television and Radiomovies; Eliminating Radio Interference; Radio Laws and Regulations; Handling and Abstracting Traffic.

An immense amount of information never before available including detailed descriptions of standard equipment is presented.

Prepared by Official Examining Officer

The author, **G. E. Sterling,** is Radio Inspector and Examining Officer, Radio Division, U. S. Dept. of Commerce. The book has been edited in detail by **Robert S. Kruse,** for five years Technical Editor of QST, the Magazine of the American Radio Relay League. Many other experts assisted them.

Free Examination

The new edition of "The Radio Manual" has just been published. Nearly 900 pages. 369 illustrations. Bound in Flexible Fabrikoid. The coupon brings the volume for free examination. If you do not agree that it is the best Radio book you have seen, return it and owe nothing. If you keep it, send the price of $6.00 within ten days.

Order on This Coupon

D. Van Nostrand Co., Inc.,
250 Fourth Ave., New York

Send me the Revised edition of THE RADIO MANUAL for examination. Within ten days after receipt I will either return the volume or send you $6.00, the price in full. (S & I 10-29)

Name .....

St. & No. .....

City and State .....

DRAFTING

Learn at Home

DRAFTING is one of the best professions a young man can choose because it pays good salaries and it is the stepping stone to even better positions. Many leading architects, mechanical engineers and electrical engineers got their start at the drafting board.

There is no easier way to learn Drafting than through the home-study courses of the International Correspondence Schools. The practical value of these courses is shown by the success of I. C. S. students and also by the fact that employers are constantly writing us for trained men. We receive more calls for I. C. S. draftsmen than for graduates of any other course.

F. E. King was "a poorly paid clerk" when he enrolled for the I. C. S. Drafting Course. By study, industry, and perseverance he became Chief Draftsman of the U. S. Steel Furniture Company, of Syracuse. He is now earning more in a day than he used to earn in a week.

A. J. Hutchins became Chief Draftsman for the American Strawboard Company and increased his salary 300%—also as a result of I. C. S. Training.

There is no doubt that Drafting offers a real opportunity to ambitious men and it will pay you to investigate it. Just mark and mail the coupon and we'll glady send you a booklet telling all about the I. C. S. courses in Drafting or other subject in which you are interested.

INTERNATIONAL CORRESPONDENCE SCHOOLS
Box 6198-F, Scranton, Penna.

Without cost or obligation on my part, please send me one of your booklets and tell me how I can qualify for the position or in the subject *before* which I have marked an X:

☐ Mechanical Drawing
☐ Draftsman's Course
☐ Boilermaker's Course
☐ Structural Drafting
☐ Architectural Drawing
☐ Sheet Metal Worker's Course
☐ Sheet Metal Pattern Drafting
☐ Boilermaker's Laying Out
☐ Ship Drafting
☐ Illustrating & Designing

☐ Mechanical Engineer
☐ Electrical Engineer
☐ Civil Engineer
☐ Steam Engineer
☐ Structural Engineer
☐ Architectural Engineer
☐ Surveyor
☐ Concrete Builder
☐ Contractor and Builder
☐ Business Management
☐ Traffic Management
☐ Bookkeeper
☐ Private Secretary
☐ Spanish and French
☐ Mathematics
☐ Machinist
☐ Toolmaker
☐ Iron and Steel Worker
☐ Patternmaker
☐ Foundryman
☐ Automobile Mechanic
☐ Architect's Blueprint Reading
☐ Electrician
☐ Apprentice Trades
☐ Salesmanship
☐ Advertising
☐ Business English
☐ Civil Service
☐ Common School Subjects
☐ High School Subjects

Name.....

Address.....

CORRECT Your NOSE

Improve your appearance with the ANITA Nose Adjuster. Shapes flesh and cartilage—quickly, safely and painlessly, while you sleep. Results are lasting. Doctors praise it. 68,000 users. Write for *30-Day Trial Offer* and *FREE BOOKLET*.

ANITA INSTITUTE, L-73 Anita Bldg., Newark, N. J.

RADIO BARGAINS!

Used 5-tube sets $14.90; Guaranteed Transformers 75c; Condensers 50c; Rheostats 25c; Crosley cone units $2.00; 1-tube sets $1.95; A. C. Filament Transformers $1.90; A & B Transformer for A. C. sets with chokes $4.25; Used Experimental 5-tube sets in cabinets $6.90. Complete list upon request. CHAS. HOODWIN CO., 4240 Lincoln Ave., Dept. 1016, Chicago, Ill.

Dealers in Bankrupt Radio Stocks

A Merry-Go-Round Demonstrates Einstein's Theory

(*Continued from page* 550)

L.—Wouldn't it also be possible to explain these effects by assuming that that automatic brass-band, there in the center, has a gravitational repulsion on the ball? (Fig. 3)

R.—Yes, indeed. Now let's experiment by moving around. Look! Here, at the outside edge of the merry-go-round the ball gets into motion more quickly than it does when we were near the inner edge. This proves that the force, be it centrifugal, attractive, or repulsive, is more powerful the farther we are from that brass-band. But it does not say what causes it. It might even be magnetic or electrostatic.

P.—I guess you're right. I can't see that there is any way to decide between the various possibilities.

R.—If I had the surrounding scene painted on canvas mounted on a turn-table and then revolved the turn-table backward, you would get all the thrill of the merry-go-round—even though it be motionless (Fig. 4).

P.—Here, let me have that piece of rock with string attached I saw in your suitcase. case.

(Relativist hands it over.)

P.—(demonstrating). If I swing this in circles about my head it is quite obvious that there is a force acting. I can feel the pull of the weight.

R.—What is more, you can measure the amount of the force. Here. Tie the other end of the string to this spring balance. Now swing it. Yes, there is a force of ten pounds registering on the pointer scale. (Fig. 5.)

L.—But I thought you just said that there was no force acting to produce the circular motion of the planets about the sun. Here is circular motion—and yet the force is quite real.

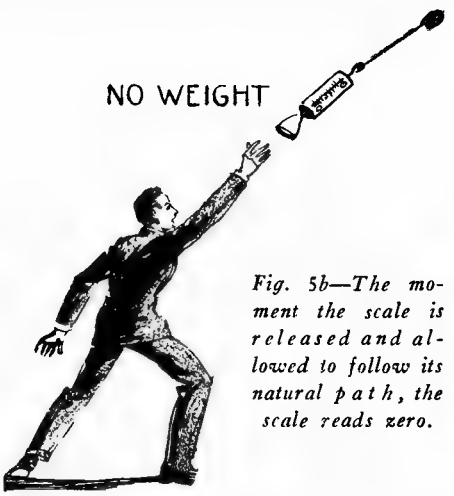


Fig. 5b—The moment the scale is released and allowed to follow its natural path, the scale reads zero.

R.—The two cases are far from analogous. Do you not recall the fundamental principle of relativity?—that an object, left to itself, tends to pursue its most natural course through space-time, and that apparent forces arise only when the object is forced to deviate from its most natural course. If you think the stone is following its natural tendencies you are greatly mistaken. Let go of the spring balance. The stone flies off on a tangent and the pointer, indicating the force, snaps to zero. The force vanishes.

L.—But is that not just because the stone is flying off in a straight line? The centrifugal force acts no longer, but there is still the force of gravitation. You have not proved that that, too, has vanished.

(*Continued on page* 573)

CAMPBELL'S

Have You Some Troublesome Ailment?

I want to send you one of my INFRA-RED Lamps to use for 30 days without obligation to purchase—so you see for yourself how quickly you will be relieved.

Infra-red (invisible) rays *penetrate deeply* into the tissues. This creates an active circulation in the congested parts, stopping pain almost instantly. *Nature herself does the healing by stimulating the normal circulation of blood.*

Sent on 30 days' trial

May be used safely by anyone. Just plug into any light socket, and concentrate the Infra-red beam on the affected part. A blessing in the home both for children and adults. Physicians say most ailments are due to congestion—relieve the congestion with Infra-red rays and you relieve the ailment.

Now—low factory price and easy terms

Write today for free book quoting medical authorities and hundreds of users. For a limited time low introductory price and small monthly payments.

Sinus Trouble
Sore Throat
Lumbago
Bronchitis
Neuralgia
Rheumatism
Neuritis
Tonsilitis
Catarrh
Ear Trouble
Hemorrhoids
Backache
Asthma
Gall Bladder

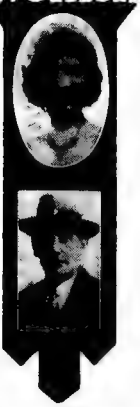
Try my Infra-red Lamp at my risk for these and other ailments.

Free Book Tell us your trouble, and we'll send free valuable suggestions for Infra-red treatment during 30-day trial period.

WM. CAMPBELL CO., Dept. 1050, ALLIANCE, O.

Dissatisfied Men AND Women

WANTED TO MAKE $40 TO $100 A WEEK



Mr. Magill earns over $50 weekly during the early months of the year, twice that amount after September first and last week made $125.00 in five days. Miss Deckterow writes that she made $66.70 in an hour June first and $27.00 in ten minutes two days later.

These are not exceptional cases, since we have people who earn from $10,000 to $20,000 a year, but any man or woman of average ability can earn from $40 to $100 weekly with our nationally known personal and business Xmas Greeting Card and Stationery lines.

We pay liberal commission in cash every day together with liberal monthly bonus and furnish magnificent samples and everything necessary to do business with—*Free.*

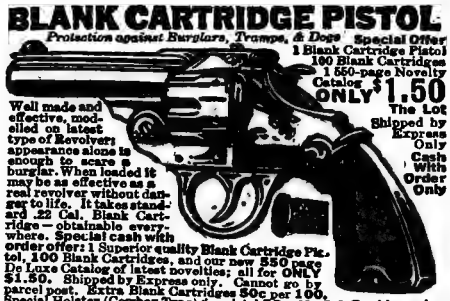
Address

Sales Manager, Dept. A 0
THE PROCESS CORPORATION
Troy at 21st Street Chicago, Illinois

BLANK CARTRIDGE PISTOL

Protection against Burglars, Tramps, & Dogs

Special Offer
1 Blank Cartridge Pistol
100 Blank Cartridges
1 550-page Novelty Catalog
ONLY $1.50
The Lot Shipped by Express Only
Cash With Order Only



Well made and effective, modelled on latest type of Revolver; appearance alone is enough to scare a burglar. When loaded it may be as effective as a real revolver without danger to life. It takes standard .22 Cal. Blank Cartridge—obtainable everywhere. Special cash with order offer: 1 Superior quality Blank Cartridge Pistol, 100 Blank Cartridges, and our new 550 page De Luxe Catalog of latest novelties; all for ONLY $1.50. Shipped by Express only. Cannot go by parcel post. Extra Blank Cartridges 50c per 100. Special Holster (Cowboy Type) for pistol 50c. No C.O.D. shipments.

JOHNSON SMITH & COMPANY, Dept. 269, RACINE, WIS.

This BOOK 10¢

Amaze and Mystify Your Friends!

Earn money at Clubs and Parties. No skill required. It's easy. "The Book of 1000 Wonders" tells how and teaches you many startling tricks of Magic. Also contains a complete catalog. Send 10c. today.

LYLE DOUGLAS
Station A-3 Dallas, Texas

WIN QUICK POPULARITY PLAY THE TENOR BANJO!

"I NEVER could figure why all the girls turned me down until Jim Reid said to me, 'Bob, you're a nice chap—but you're "dead." Why don't you "pep up"? You'll never get anywhere the way you are now!'

"Jim was right. But what could I do about it? Then I saw an ad—'My Banjo Made Me Popular Over Night.' Here was my big chance. I sent for details . . . and well——

"In almost no time, it seems, I was able to play even the most difficult pieces. I took my banjo to our next party. Classical tunes, jazz, 'hot numbers,' they came as easy as rolling off a log. That night started me towards popularity—and has won me a better job and the sweetest girl in the world." Do you want to be popular—to win quick success and make money on the side? Take your first step by sending **today**, now, for details as to how you can learn to play the tenor banjo at home—easily—QUICKLY!

TENOR BANJO STUDIOS
Dept. A-202 9th Floor Woolworth Bldg.
New York City

Vibraphones Reduce Head Noises

A new and scientific discovery stimulates the hearing processes by utilizing sound waves through small silver devices that fit the ears perfectly. The vibrators are built inside the sound chambers. The instruments are so small that your friends will seldom know you are wearing them. Comfortable, easily put in the ears or removed. No wires. No batteries. No head bands. Nothing like them. This new and scientific triumph produces marvelous results. Head noises are reduced. And hearing gradually improves. Don't be handicapped or embarrassed another day by deafness.
Write for complete details.
VIBRAPHONE CO., Inc., Station 325
Central National Bank Building, St. Louis, Mo.

WORLD NEEDS PLUMBERS

Old style plumbers are fading like the horse and buggy. The world demands modern Plumbing and Skilled Trained Mechanics to do it. Unlimited, swift growing field. Make $50 to $100 a week or start own shop. We train you quick. Learn in 8–12 WEEKS to do any job with skill and science. Need no previous experience. Strictly tool using system. Opportunity knocks. Investigate today—amazing offer—low tuition. World's greatest school. Write—
UNIVERSAL PLUMBING SCHOOL
2157 Troost Ave. Kansas City, Mo.

HB PAINT "SPRAY DOES THE WORK OF FIVE MEN"

Paint Spraying Brings Quick, Easy Profits—HB does work of 5 brush painters. Paints autos, furniture, houses, at lowest prices, with big profits for you. *Pays for itself*—only $20 monthly. Easy lowest terms brings it. Practically no investment. 30 *days' trial.* Write for valuable bulletins.
Hobart Brothers Co., Box S1091, Troy, Ohio.

EASY TERMS, 30 DAYS TRIAL QUICKLY PAYS FOR ITSELF.

To be sure of getting your copy every month, subscribe to SCIENCE AND INVENTION, $2.50 a year. Experimenter Publications, Inc., 381 Fourth Avenue, New York City.

Home Movies

By Don Bennett

(*Continued from page* 521)

Stop	Square
f32	1024
f22	484
f16	256
f 8	64
f 5.6	31
f 4	16
f 2.7	7.4
f 2	4
f 1.5	2.2

"f1.5 is the largest lens stop used in commercial practice, a lens with that opening being available for amateur use. A lens with an aperture of f0.5 was once made in a laboratory but was commercially impractical.

"Two stops with which lenses are usually marked have been left out of this list, stops f6.3 and f4.5. F4.5 is exactly double f6.3 and falls midway between f4 and f5.6 while f6.3 is between f5.6 and f8. Thus if your exposure called for f8 and you were using a graduated filter set so that an increase of 50% in exposure were required, f6.3 would be the proper setting.

"Selection of the proper filter or the proper density on your graduated filter is necessary in autumnal photography if good color values are required. The usual filters, yellow in color, will subtract the yellow, making it appear almost white, and will bring out the red in a medium gray tone, while the green will appear normal.

"Amateurs who use color have a splendid opportunity to test the color range of their cameras at this time of the year. There is one thing to remember, though, bright yellow usually reproduces as white, especially in very bright sunlight. Also, if your exposure is too great, color fringing is liable to result. This is especially true in beach scenes and the neutral density filter should be used as instructed. This neutral density filter is a thin gray disc of glass that reduces the exposure without affecting the color, except to improve it where strong light is present.

"The proper care of your filters will assure a long life, whereas lack of care will result in dirty, streaky pictures and a possible breakdown of the filter material. Gelatin filters, whose only reason for existence is their cheapness, must not be handled with the bare fingers. The sweat and oil present on the surface of your fingers will cause minute portions of the gelatin to dissolve and lose their filter value besides serving to distort the picture through refraction. Glass filters should be kept in a soft envelope of flannel or chamois so they cannot become scratched and they should be wiped off with lens tissue before use.

"You have your choice of several ways of mounting your filters, you can use the squares with a suitable holder to clamp over your lens; the cells, which are round and have spring sections on the side to clamp them to the lens, and with the graduated filters, a tension mount that permits you to use any section of the filter at will.

"My advice to you is to take an exposure meter, a few filters, some panchromatic film and your camera, go out in search of color and experiment. That is always the best way to learn."

(Next month's article will describe the preparations for a Hallowe'en movie party that will amaze your friends. Simple animated cartoons and a big surprise will be described.)

A High School education is your passport to the world of big business

Take Your First Ten High School Lessons FREE!

NOW you can have, in one volume, a regular ten-lesson course absolutely free, to introduce the High School Home Study Bureau to those who are not yet familiar with its service. Read this volume at your leisure and get a taste of the pleasure and profit you will derive from a High School education such as *we* offer. You are not obliged to *buy* anything. This book is yours to keep for all time, whether you decide to continue your education or not.

Did you miss your chance to go to high school? You need no longer be handicapped! Now you can have your high school education—in your spare time at home. An amazingly easy new plan has been developed—as simple as a-b-c, as fascinating as a game! No tedious study—no laborious lessons! Just a few minutes of pleasant reading a day.

Every high school subject covered in fascinating questions and answers: Biology, Civics, Ancient History, American History, Arithmetic, Elementary Algebra, Physics, Geography, Physiography, Modern History, Literature, Economics, Latin, English Grammar, Spelling.

With these fifteen volumes, you have at your command fifteen expert instructors, each one teaching you in your own home, and you can qualify for our certificate.

Without a high school education you cannot hope to get far in life. The better positions, the bigger salaries, are barred from you. Why chain yourself to a low-pay, blind-alley job, when a few minutes of pleasant reading a day will open the door to BIG opportunities?

Our space here is limited. It is impossible to suggest one-tenth of the benefits of a High School Education to you. **You know them yourself!**

We have selected the volume in Ancient History for free distribution, because every educated person should know how much we owe to the Egyptians and the Romans and the Greeks for our present civilization.

Send at once for the complete course in Ancient History, presented in fascinating questions and answers. There is no charge for this volume, which regularly sells for $1.50. Just 25c to pay for postage and packing. At the same time we shall send you a free book, "New Way to Get a High School Education at Home." ACT NOW! High School Home Study Bureau, Inc., 31 Union Square, Dept. K-29, New York, N. Y.

HIGH SCHOOL HOME STUDY BUREAU, INC.
31 Union Square, Dept. K-29, New York, N. Y.

Send me the High School Course in Ancient History for my own, to keep for all time. I want the volume which regularly sells for $1.50 and which I am to get without any obligation whatever. I enclose 25 cents to pay for postage and packing. Also send me your free book, "New Way to Get a High School Education at Home."

Name .....

Address .....

City ..... *State* .....

ELECTRICAL ENGINEERING

BOOKS SENT FREE

New Edition Containing 100 Pages on

A-C RADIO!

8 FLEXIBLE MAROON VOLUMES
4300 pages, 3200 illustrations, deluxe gold stamped binding, index in each book, general index in Vol. 8. Covers every subject in Electricity—Light, Power, Transmission, Generators, Motors, Switchboards, Radio, Telephone House Wiring Railways, etc.

We're glad to send a set to your home to examine and use as your own for 15 days—to show you that here is the most up-to-date and complete work on Electricity ever published. Written by CROCKER of Columbia U.—MILLIKAN of Calif. "Tech."—HARRISON of General Electric and 26 other noted Electrical Engineers. Starts off with elementary Electricity in simple, non-technical language for the beginner and includes every Engineering branch for use of experts on the job.

Complete Electrical Reading Course

Electricity, the biggest industry in the world, continues to grow the most rapidly. And it offers better jobs, bigger salaries and a brighter future than any other field. *Every dollar, every hour invested in learning Electricity will come back to you a thousand-fold.* Learn in spare time with these books at *one-fifth* the cost of trade courses. Outline for organized study, quiz-questions and a year's free consulting membership in the American Technical Society *included without extra cost*, if you mail coupon immediately.

Look it up!
Thousands of these sets are used as REFERENCE books by men employed in electrical, building construction and allied lines. The JIFFY INDEX puts the answers to 20,000 questions right at your finger tips.

AMERICAN TECHNICAL SOCIETY
Dept. E-725
Drexel Ave. & 58th St., Chicago

American Technical Society
Dept. E-725 Drexel Ave. & 58th St., Chicago

Please send for 15 days' free trial 8-volume set of Electrical Engineering just off the press, subject to return if I wish to. (I pay the few cents express charges on receipt of books, you pay express if returned.) If I decide to keep them, I will pay $2.00 after 15 days trial, then $3.00 a month until $34.80, special advertising price, is paid, after which books become my property. Year's Consulting Membership to be included free.

Name.....

Address.....

Employed by.....

Employer's Address.....

You, Too, Can be Playing—Before Christmas!

Surprise all your friends, make new ones, sure popularity before Christmas by learning to play a Pan-American saxophone, trumpet, clarinet, or any band instrument. Only a few lessons, and you can play any popular air—so easy to learn.

Moderately Priced

Sent on free trial. Easy time payments. Only **moderately** priced band instrument, **factory** guaranteed. Recommended by professionals and band masters everywhere. Write today for free illustrated catalog.

IT'S A PAN-AMERICAN

PAN-AMERICAN BAND INSTRUMENT & CASE CO.
1005 Pan-American Bldg., Elkhart, Ind.

Magic Cleaner **Ends Mussy Unsafe Methods**

Counter Plan Offers Agents $20 Daily
Here's the most sensational cleaning invention in 25 years. Just what everyone has long been waiting for. "SPEED" is new! Different! A magic bottle that whisks away spots and stains the moment it's turned upside down. Ends spilly liquids and smelly rags forever. Non-inflammable! Non-Explosive! Starting Offer GUARANTEES your sales on self-selling Counter Carton Plan. No risk! Write quick.

SPEED CLEANER CO.
Dept. 895, 190 N. State St., Chicago, Ill.

Grow New Plants Without Any Seeds

By Dr. Ernest Bade

(*Continued from page* 519)

are usually taken, a number of them tied into a bundle and the bundle sunk into the ground in a shady and moist spot. They are usually placed about four inches into the ground. The California privet which is so much used for hedges is propagated by this method. The cuttings are made in March and they are placed in a trench one next to the other. Then an inch layer of moss is placed in the trench and this covered with soil. When the soil is dry it must be watered.

Berry Bushes

BERRY BUSHES may also be multiplied by this method. Here one year old shoots are cut about ½ a foot length by winter pruning. The shoots are bundled and hung in a frost free room or cellar until spring. Then they are taken out of doors and placed in the soil, spacing about a foot apart. All buds with the exception of the upper two are removed, the cuttings being planted so that only these two buds protrude. These cuttings will soon grow provided the beds are kept free from weeds.

Shoots of currants may be cut early in the spring before they are in leaf and planted. Layers are made from gooseberries. That is, a branch is taken, a girdle cut in the bark about ⅛ of an inch in width, and the twig, with its girdle placed a few inches into the ground, the twig being held in position with a hook sunk into the ground. A few months later the twig sunk into the ground will have rooted and it may be cut from the mother plant and transplanted.

The barberry, another plant much used for hedges is most easily propagated by sinking a few branches into the ground and leaving a few months. Then these branches will have rooted and they may be cut off. Each of these branches then forms a new plant.

Tradescantia, an ornamental plant, produces roots so easily that it is only necessary to place it in contact with moist soil.

New Plants from Leaves

IT is not even necessary to use a twig for producing a new plant, sometimes it is sufficient to use a leaf. Such leaf cuttings are even used by the gardeners. At times not one plant, but three or four may be formed by a leaf. Take the case of Bryophyllum calycinum. After cutting off a leaf near the petiol the cut surface must be left to dry. Then a few notches are cut on the veins at the margin of the leaf. When the leaf is somewhat withered it is placed in a flower pot containing a sandy soil which must be kept moist. A glass plate covers the pot and this tends to keep the temperature and moisture content in the pot as uniform as possible. Soon roots will be formed at the notches and small leaves will make their appearance at these points. The large leaf acts as a storehouse of food for the undeveloped plants and when they are capable of growing themselves the old leaf dies and a number of new plants is the result.

The leaf of the Begonia rex may be treated in a similar manner. But here the veins are cut at a place where two veins join. If the plant is grown in a greenhouse. the leaf need not be cut off the mother plant. New plants form at the cut veins and may be cut off after they have developed sufficiently to be potted.

. . . A New IDEAL Model Airplane

The
"American Eagle"

Wing Span 26 in. Weight: 3¾ oz.

Distinctive in design . . . new in construction. . . . a light, durable, fast-flying model with IDEAL'S twenty years' experience behind it, and months of dependable performance before it! Wonderful stability in the air, and GUARANTEED to FLY when hand or ground launched. Constructed largely of Balsa wood, with many new features; motor can be wound with winder without removing from fuselage; indestructible landing gear; new type propeller. Construction is easy, also sold completely assembled.

Construction Set $2.50	Assembled Model $5.00

Ford Tri-motor Monoplane
3 ft. Model. Construction Outfit, $8.50
Sold by Toy, Sporting Goods and Department Stores. Ask for the IDEAL Model Airplanes. If unobtainable, order direct. West of Denver, prices are 50c higher.
64-Page Catalog of Models, Parts and Supplies for Builders 5c
IDEAL AEROPLANE & SUPPLY CO., Inc.
22-24 West 19th St., New York City

Stop Using A Truss

STUART'S ADHESIF PLAPAO-PADS are entirely different—being mechanico-chemico applicators—made self-adhesive purposely to keep the muscle-tonic called "Plapao" continuously applied to the affected parts, and to minimize danger of slipping and painful friction. The fabric is soft as velvet, and being adhesive

Awarded Gold Medal

clings closely to the body without straps, buckles or springs. Easy to apply, comfortable, inexpensive.

Awarded Grand Prix

For almost a quarter century stacks of sworn testimonials from many different countries report success—without delay from work. The epidermatic absorption of Plapao and the utilization of "plaster therapy" tend toward a natural process of recovery, *after which no further use for a truss.* Test of factor "PLAPAO" sent Mail Coupon below TODAY— **FREE**

Plapao Laboratories, Inc.
393 Stuart Bldg., St. Louis, Mo.

Gentlemen: Send me a Free Trial Plapao and 48-page book on Rupture. No charge for this now or later.

Name.....

Address.....

AUTOMATIC WINDOW WASHER
Sells for $1.98

Washes, Cleans, Dries Polishes in One Quick Operation

Amazing new invention. CARRIES OWN WATER SUPPLY! • Eliminates all drudgery and splashing! 5 times as fast as old methods. Patented features: **No pail. No brush. No sponge. No chamois.** Can be used with or without a pole. **$90-$150 weekly easy for agents.** Sells on sight. Sensational demonstration! Every housewife, autoist, store-owner a prospect. Write for our **Free Sample Offer** and big money-making proposition. Be first.

NATIONAL INDUSTRIES, Dept. 2010 67 E. Lake St., Chicago

PSORIASIS

IT IS UNNECESSARY TO SUFFER WITH THIS DREADFUL SKIN DISEASE. I SUFFERED FOR YEARS. WRITE R. S. PAYNE, 234 E. 2nd ST., COVINGTON, KENTUCKY.

Choose as Your Profession

Electrical Engineering

Electricity offers a brilliant future to the young man who is about to choose his career. Never before has there been such wonderful opportunity in this great field. Big paying positions in electrical work the world over are open to trained men—men who possess specialized, practical knowledge. Come to the School of Engineering of Milwaukee—the largest, the best equipped electrical school of its kind in America. Here you are trained in both theory and practice by a faculty of experts. You learn in large, finely equipped laboratories. If you have 14 high school credits or equivalent, you can become an Electrical Engineer with a Bachelor of Science degree in 3 years. If you have not finished high school you can make up the credits you lack in our short intensive Junior Electrical Engineering course.

B. S. Degree in 3 Years

Practical Electrical Education

Learn by the thorough, approved scientific methods which our twenty-three years of specializing enable us to give you. In addition to Electrical Engineering, the following complete courses are given: *A.C. and D.C. Armature Winding—Wiring and Testing—Practical Electricity—Commercial Electrical Engineering—Junior Electrical Engineering and Automotive Electricity, Electrical Refrigeration, and Radio Sales and Service.*

EARN WHILE YOU LEARN

Ambitious men who can finance their tuition can earn money to help defray expenses while learning. Our wonderful co-operative plan brings an Electrical Career within the reach of every ambitious man. Our Free Employment Department secures positions for those students who wish to earn part of their expenses. In addition, *the Department will help you get a good position in the Electrical industry when your training is completed.* Daily Broadcasting WISN.

Fall Term Opens NOW

Write for FREE CATALOG

Mail the coupon today for our big new illustrated catalog. Mention the course that interests you most and we will send you special information. Read about the school that trains men for *practical and quick success.* See how easy it is for you to get the training that will enable you to step to a splendid position and a handsome income. *Mail the coupon right NOW. No cost or obligation.*

SCHOOL of ENGINEERING of Milwaukee

Founded 1903

Dept. S.I. 929

Jackson & E. Wells Sts. Milwaukee, Wis.

SCHOOL OF ENGINEERING OF MILWAUKEE
Dept. S.I. 929, E. Wells and Jackson, Milwaukee, Wis.

Without obligating me in any way, please mail free illustrated book, "Electricity and the One Best Way to Learn It," and particulars regarding the course I have marked with an X.

RESIDENT COURSES:

....Electrical Engineering, B. S. Degree. (3 years.)
....Commercial Elec. Eng. (H. S. graduates 1 year —others 2 years.)
....Armature Winding.
....Light, Motor Wiring and Testing.
....Electrical Refrigeration.
....Master Electrician.
....Automotive Electricity.
....Radio Sales Service and Broadcasting.
....Home Laboratory Service. (Home Study Course.)
....I am interested in your "Earn While You Learn" plan.

Name.....Age.....

Address.....

City.....State.....

Education.....

Coal Miner's Job Safer Than Yours!

By Alvin F. Harlow

(*Continued from page* 507)

jeopardizing not only their own and their fellows' lives but the mine's chances of winning honors in various safety contests.

Meanwhile the Bureau of Mines as well as some of the large operators are issuing circulars which hammer constantly at the subject of hazard and prevention. These circulars are full of pictures illustrating "Dangerous Practice" and "Safe Practice"; posed photographs show in vivid style how the heedless miner is caught under falling masses of rock, crushed between car and wall, gets his foot caught in a switch frog and is run over, walks along a haulage track with an iron crowbar over his shoulder, which touches the trolley wire and gives him a fatal shock—and many other possible mishaps.

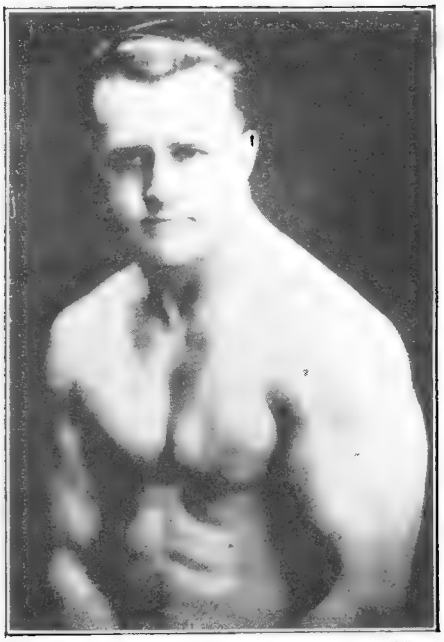
The Bureau even issues a Miner's Almanac, with the usual day-by-day information about the sun and moon, while about half the space in the columns usually given over to historical dates is filled with crisp remarks on safety, health and sanitation—hints on ailments of children, care of the teeth, malaria and mosquitoes, drinking water, flies, physical examinations at regular intervals, warnings against patent medicines, venereal diseases, sanitary housing, mine gases, dust and ventilation, importance of learning the English language and so on.

Superintendents, foremen and bosses are constantly being stimulated and instructed in safety by bulletins and circulars, by visitation and by district meetings and schools. An unusual agency for disseminating safety information is found in an iron mine at Eveleth, Minnesota, 215 feet below the surface—a moving picture auditorium where once or twice a week, at the noon hour, the men are shown safety propaganda films, the show always ending with a bit of comedy.

The Bureau of Mines maintains safety stations in all the great mining districts of the country, and likewise a number of so-called Mine Rescue (railroad) Cars. These cars are manned by experts in safety and rescue work and are ready at a moment's notice to rush to the scene of a great disaster; but their principal function and the one to which they are happily able to devote most of their time is that of going from place to place, spreading safety propaganda and instruction. Ten thousand miners are being trained annually in first aid work and the use of gas masks; and a much larger number are reached by lectures, demonstrations and publications.

Safety committees composed in part or wholly of the miners themselves are doing important work in conserving life and limb. In addition to committee recommendations, some companies request suggestions from individuals. The Bureau of Mines makes the startling statement that "one of the largest concerns received in two years 5,200 suggestions . . . of which 92 per cent were adopted. Another plant received 1,200 suggestions the first year. Of these, 90 per cent are now operative, 6 per cent are being investigated and only 4 per cent were rejected as being impractical."

Expert first aid and rescue work has become an important feature of the industry, being stimulated by numerous State, district and local contests. One big steel concern alone has in its mills and mines more than 22,000 employes who have been trained in such work. The skill attained by some of these amateur



EARLE LIEDERMAN—*The Muscle Builder*
Author of "Muscle Building," "Science of Wrestling," "Secrets of Strength," "Here's Health," "Endurance," etc.

Kill This Man

There's a devil inside of you. He's trying to kill you. Look out for him! He tells you not to work so hard. What's the use—the boss only piles more work on you. He tells you not to bother with your body. Do you recognize him? Of course you do. He's in us all. He's a murderer of ambition. He's a liar and a fool. *Kill him!* If you don't, he will kill you.

Saved

Thank your lucky stars you have another man inside of you. He's the human dynamo. He fills you full of pep and ambition. He keeps you alive—on fire. He urges you on in your daily tasks. He makes you strive for bigger and better things to do. He makes you crave for life and strength. He teaches you that the weak fall by the wayside, but the strong succeed. He shows you that exercise builds live tissue—live tissue is muscle—muscle means strength—strength is power. Power brings success! That's what you want, and gosh darn your old hide, you're going to get it.

Which Man Will It Be?

It's up to you—Set your own future. You want to be the Human Dynamo? Fine! Well, let's get busy. That's where I come in. That's my job. Here's what I'll do for you.

In just 30 days I'll increase your arm one full inch with real live, animated muscle. Yes, and I'll add two inches to your chest in the same time. Pretty good, eh? That's nothing. Now come the works. I'll build up your shoulders. I'll deepen your chest. I'll strengthen your whole body. I'll give you arms and legs like pillars. I'll literally pack muscle up and down your back. Meanwhile I'll work on those inner muscles surrounding your vital organs. You'll feel the thrill of life shooting up your old backbone and throughout your entire system. You'll feel so full of life you will shout to the world. "I'm a man and I can prove it."

Sounds good, what? But listen! That isn't all. I'm not just promising these things. I guarantee them! It's a sure bet. Oh boy! Let's ride.

Send for my New Book

"Muscular Development"

64 pages and—IT'S FREE

What do you think of that? I don't ask one cent. And it's the peppiest piece of reading you ever laid eyes on. I swear you'll never blink an eyelash till you've turned the last cover. And there's 48 full page photos of myself and some of my prize-winning pupils. This is the finest gallery of strong men ever assembled. And every last one of them is shouting my praises. Look them over. If you don't get a kick out of this book, you had better roll over—you're dead. Come on then. Take out the old pen or pencil and sign your name and address to the coupon. If you haven't a stamp, a postal will do. But snap into it. Do it now. Tomorrow you may forget. Remember, it's something for nothing and no string attached—no obligation. GRAB IT!

EARLE LIEDERMAN

Dept. 2710 305 Broadway New York City

EARLE LIEDERMAN
Dept. 2710, 305 Broadway, New York City

Dear Sir:—Please send me, absolutely FREE and without any obligation on my part whatever, a copy of your latest book "Muscular Development." (Please write or print plainly.)

Name ..... Age .....

Street .....

City ..... State .....

Courtesy Warner Bros.

5 New Mystery Thrillers

—and a single $1 brings all 5 to you

NOT a cent more to pay—not even postage! We send you *all 5* of these complete new mystery novels postpaid for a single dollar!

A single dollar brings you a dozen thrilling, mystifying evenings—a hundred enjoyable reading hours—keen, intriguing, mind-exercising moments that are the perfect relaxation and mental pleasure for the person just home from a hard day's work.

The World's Great Leaders Read Them

All the great world leaders are rapidly turning to this type of story in their hours of quiet relaxation. Men like former Secretary of State Kellogg and His Majesty King George recognize and approve the helpful stimulation such reading affords.

Imagine Paying Only 20c Apiece!

And now you, too, can enjoy these 5 new mystery thrillers at the almost unheard of price of $1.00 for all 5. Imagine paying 20c for a complete, book-length novel written by one of the most famous authors! It's a price we have made to help the man who wants the best in mystery stories, without having to pay for a lot of fancy binding. We've cut our costs to the bone, but the complete novel is still there, just as you might buy it in any bookstore for $2.00.

All you have to do is fill out the coupon, pin a dollar bill or your check or money order for a dollar to it, and mail it back to us at once. And we mean *at once*, for we've made such a hit with this new, inexpensive style of mystery novel that our stock of novels can't last forever. Get your order in now, and then you'll be sure to get the biggest novel bargain you ever heard of—5 Big Mystery Thrillers all for a single $1!

Perfect Satisfaction or Your Money Back

If you are not perfectly satisfied, let us know and we will refund your dollar.

The Murder in the Laboratory

A notebook lay beside the poisoned body of Sheppery, and in it he had scrawled a ragged numeral 3 before he died. It may mean something—but what? Dr. Blythe, famous research critic, sets to work to prove some of his theories, and in so doing provides a story seldom equalled for real thrills.

The Black Magician

"Why did they kill him?" asked his secretary. "Because he forgot his glove!" was the cryptic answer from Secret-Service Smith, world-famous detective. But Smith was concerned, for his traditional enemies had killed the man on the very doorstep of his own home—and that demanded vengeance! Another famous Secret-Service Smith mystery novel by R. T. M. Scott.

The Taxi Murder

On the side of a road they found him—in the spring mud of Illinois. He'd been shot in the back of the head three times—but there didn't seem to be a single clue. Yet, when they discover he was the outcast son of a millionaire, Michael Thomas, famous Chicago Detective, is put on the trail. A story of the Illinois Underworld, and its rise since the World War.

The Latimer Murder Case

Sergeant Barry Odell of the New York Police goes on a winter vacation, and finds plenty of work to do. For the wealthy Mr. Latimer has been found murdered in the snow, and all evidence points to his beautiful young wife. But Barry never jumps at conclusions, and sets to work on the supposition that to prove a person innocent, you've got to find another who is guilty. A real mystery novel that you won't drop until it's finished.

The Ingram Murders

Eight people were within 25 feet of Ames Ingram when he was cruelly murdered in his own palatial home. All of them could have done it, but all of them seemed to have perfect alibis. Could it have been the monkey? Tom O'Shanter, daughter of the old police chief, sets out to solve the mystery, and runs into another still more baffling. One of those novels that mystery fans rave over. See if you can figure out the guilty one.

NOVEL MAGAZINE COMPANY
Dept. 2510XX, 381 Fourth Avenue, New York City, N. Y.

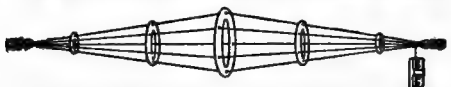
Gentlemen: I enclose $1.00 for which please send me, postpaid, the following 5 Complete Novels: "The Murder in the Laboratory," "The Black Magician," "The Taxi Murder," "The Latimer Murder Case," and "The Ingram Murders." I understand that I can return these if not perfectly satisfied, and get my dollar back.

Name .....

Street Address .....

City ..... State .....

LIFE-TIME DX AERIAL



Guaranteed Double Volume and Sharper Tuning

Description of Lifetime DX Aerial

No. 30—LENGTH 30 FEET:

Assembled ready to string up. Brings in volume of 150-ft. aerial but retains the selectivity of a 30-ft. aerial. Rings are heavy gauge solid zinc. Duplicates in design and non-corrosive materials the aerials used by most of largest Broadcasting Stations. Design permits using this powerful aerial in 30-ft. space (preferably outside). Sharpens tuning of any receiving set because of short length but has enormous pick-up because 150 ft. of No. 12 enamelled wire is used. Made for owners of fine radio sets who want great volume on distance without destroying sharp tuning. (Also used by many owners of short-wave outfits.) "Makes a good radio set better."

PRICE, $10.00

No. 60—LENGTH 60 FEET:

Assembled—ready to string up. "Big Boy" size. (Same description as above except that 300 ft. of wire is used, making this the most efficient and powerful aerial possible to manufacture.)

PRICE, $12.50

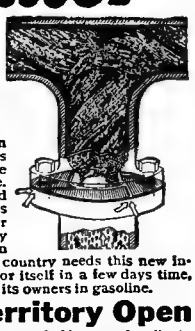
Manufactured by

THOROLA RADIO PRODUCTS,

1014 So. Michigan Avenue Chicago, Illinois

Is Your Car..... A Gas Eater

New Invention Increases Mileage on Auto Gas Eater from 13½ to 34.6 Miles on a Gallon



An astonishing new device has been perfected that is amazing car owners everywhere. Goerzen reports increase from 13½ to 34.6 miles on his Dodge. Thousands have been installed and users report 30-40-50 and more miles on a gallon of gas. In addition power is increased, instant starting and flashy pick-up is noticed and carbon formation disappears. Every car owner in the country needs this new invention. Its cost is so trivial it pays for itself in a few days time, yet it will save hundreds of dollars for its owners in gasoline.

$100 a Week Territory Open

$5.00 an hour for spare time. Men are needed in every locality to take care of the tremendous local demand. Sales ability is not required. Every car owner will buy on sight. Ideal for spare time workers.

FREE To help our workers we furnish them with this marvelous Whirlwind gas saver free for their own cars. Quick action is necessary. Be the one in your locality to cash in on this device which every auto owner will buy. Send today for full particulars and free sample offer.

Whirlwind Mfg. Co., 999 83-E Third Street, MILWAUKEE, WISC.

Play the Hawaiian Guitar like the Hawaiians!

Only 4 Motions used in playing this fascinating instrument. Our native Hawaiian Instructors teach you to master them quickly. Pictures show how. Everything explained clearly.

Play in Half Hour After you get the four easy motions you play harmonious chords with very little practice. No previous musical knowledge needed.

Easy Lessons Even if you don't know one note from another, the 52 printed lessons and clear pictures make it easy to learn quickly. Pay as you play.

GIVEN *when you enroll* **—a sweet toned HAWAIIAN GUITAR, Carrying Case and Playing Outfit Value $18 to $20** *No extras-everything included*

WRITE AT ONCE for attractive offer and easy terms. A postcard will do. ACT!

OTHER COURSES Tenor Banjo, Violin, Tiple, Tenor Guitar, Ukulele, Banjo Ukulele. Under well-known instructors.

FIRST HAWAIIAN CONSERVATORY of MUSIC, Inc. 9th Floor, Woolworth Bldg., Dept. 249 New York, N. Y.

Approved as a Correspondence School Under the Laws of the State of New York—Member National Home Study Council.

teams is not surpassed by that of any professional hospital staff.

In some mines underground first-aid stations are now being installed. The rooms have board floors, whitewashed walls and electric light. One ingenious idea is that of a galvanized cylinder, 9 by 36 inches, containing a stretcher, a woolen blanket, a rubber blanket, several kinds of bandages, gauze, cotton, antiseptics, drinking cup and a few simple instruments and remedies. This is kept in the station and can be used there or carried to the scene of the accident.

One subject now being taught miners is the science of walling themselves in by erecting gas-proof barricades across side entries or dead ends when fires or explosions occur, and thus protecting themselves until help can reach them. In the Cherry, Illinois, disaster in 1909, twenty men walled themselves in thus, and were rescued after being entombed seven days. But recent years have developed a still better idea, first used by some mines in the Central States—namely, to build in the main section of the mine occasional refuge chambers to which the men may retreat in case of disaster and close themselves in, the doors being gas-tight. The rooms are stocked with canned food and water and air pipes are run into them from the compressor. The refuges already in service have received practical tests and have saved a number of lives.

The "Self Rescuer" is a new and valuable device which enables men to make their way through the terrible after-damp or carbon monoxide following an explosion. It is a little box-like affair no larger than one's hand and is enclosed in a sealed container which may be hooked to the belt or carried in a coat pocket. If an explosion occurs, the miner applies the mouth and nose piece at the end of the device, and holding it in place with one hand, breathes through it. The box contains a chemical which changes carbon monoxide to carbon dioxide—that is, it doubles the quantity of oxygen in the molecule. With its aid a man can walk for from thirty to seventy minutes through any percentage of carbon monoxide likely to be found in a mine after an explosion or a blast—which will in most cases enable him to reach fresh air.

One company records on bulletin boards the important accidents to employes and points out the particular carelessness or disregard of regulations involved. The board also announces that So-and-so was discharged for taking matches into the mine or for jumping on a "man trip" of mine cars after the train had started, in violation of the rules. A miner entering an employment office nowadays is apt to be confronted by a large sign which reads:

SAFETY FIRST

Unless you are willing to be careful and avoid injuries to yourself and fellow workmen, do not ask for employment. WE DO NOT WANT CARELESS MEN IN OUR EMPLOY.

And when he goes underground he encounters not only printed safety bulletins but perhaps a large "Safety First" admonition in electric lights somewhere in one of the main passages. One such sign is located two miles from the entrance in a mine in Idaho.

Not only by precept but by deed does the up-to-date mine management carry on the movement. The physical appearance of the modern mine would be a revelation to a medieval coal-digger. If it enters a hillside in tunnel fashion it is apt to have a trim-looking concrete portal. Sometimes the men enter by a similar portal quite separate from the main entrance into which the car tracks run.

PICK YOUR JOB

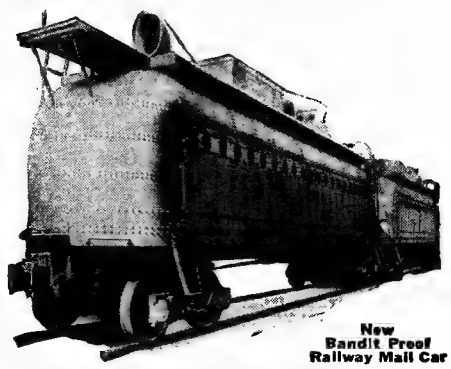
Railway Postal Clerks
City Mail Carriers
City Post Office Clerks
General Office Clerks

NO "LAYOFFS"

These are steady positions. Strikes, poor business conditions, or politics will not affect them. Government employees get their pay for twelve full months every year.

$1,900 TO $2,700 A YEAR

Railway Postal Clerks get $1,900 the first year, being paid on the first and fifteenth of each month. $79.17 each pay day. Their pay is quickly increased, the maximum being $2,700 a year. $112.50 each pay day.



New Bandit Proof Railway Mail Car

Railway Postal Clerks, like all Government employees, have a yearly vacation of 15 working days (about 18 days). On runs, they usually work 3 days and have 3 days off duty or in the same proportion. During this off duty and vacation their pay continues just as though they were working. They travel on a pass when on business and see the country. When they grow old, they are retired with a pension.

CITY MAIL CARRIERS
POST OFFICE CLERKS

Clerks and Carriers now commence at $1,700 a year and automatically increase $100 a year to $2,100 and $2,300. They also have 15 days' paid vacation. City residence is unnecessary.

GOVERNMENT CLERK—FILE CLERK
(Open to men and women 18 to 50)

Salary $1,260 to $2,500 a year. Pleasant clerical and filing work in the various government departments at Washington, D. C., and other cities throughout the country.

IS YOUR JOB STEADY?

Compare these conditions with your present or your prospective condition, perhaps changing positions frequently, no chance in sight for PERMANENT employment; frequently out of a position and the year's average salary very low. DO YOU GET $1,900 EVERY YEAR? HAVE YOU ANY ASSURANCE THAT A FEW YEARS FROM NOW YOU WILL GET $2,100 TO $2,700 A YEAR?

YOU CAN GET THEM

Country residents and city residents stand equal chance. Experience is usually unnecessary, and political influence is not permitted. Let us show you how.

GET FREE LIST OF POSITIONS

Fill out the following coupon. Tear it off and mail it today—now, at once.

DO IT NOW—This investment of two cents for a postage stamp may result in your getting a Government Job.

FRANKLIN INSTITUTE
Dept. B-177, Rochester, N. Y.

Rush to me entirely free of charge (1) a full description of the position checked below; (2) Free Copy of 32-page book, "How to Get a U. S. Government Job"; (3) A list of the U. S. Government Jobs now obtainable; (4) Send particulars telling how I can get the position I have checked.

- ☐ Railway Postal Clerk.....($1,900-$2,700)
- ☐ Post Office Clerk.....($1,700-$2,300)
- ☐ City Mail Carrier.....($1,700-$2,100)
- ☐ Rural Mail Carrier.....($2,100-$3,300)
- ☐ Government Clerk—File Clerk.....($1,260-$2,500)
- ☐ Income Tax Auditor.....($2,300-$3,100)
- ☐ Prohibition Agent.....($2,300-$2,800)

Name .....

Address .....

Use This Coupon Before You Mislay It.

Hotter than Coal and no dirt

A New Invention Do away *forever* with the drudgery of wood or coal. The most simple and economical invention on the market is now giving perfect satisfaction to enthusiastic users everywhere.

Burns 96% Air—4% Cheap Oil

The International Oil Burner fits in the fire box of any range, stove or furnace. Installed in a few minutes. No noisy motor or complicated parts.

Costs Only a Few Dollars

Heats just as well as a $400 or $500 oil burner without electricity or gas. Simply turn one valve and you have all the heat you want. Cleaner and better for heating and cooking. Approved by National Underwriters' Laboratories and engineers everywhere. Over 100,000 in use.

30 Days FREE Trial Offer

Try this wonderful burner right in your own home at our risk. Act quickly and get our special low introductory price. Sold under absolute money-back guarantee. Write at once for free booklet on home heating and *Radio Programs* free burner offer.

Listen in on our

AGENTS—Our men are making big money introducing International Oil Burners. The demand is enormous. We want spare or full time workers immediately. If $500 a month and more interests you, write or wire us for our protected territory offer.

----------Clip This Coupon----------

INTERNATIONAL HEATING CO.
3808 Park Ave., St. Louis, Mo., Dept. O-3

Send your free booklet and free details on home heating for stove ☐ furnace ☐. Also free burner offer.

Name.....

Address.....

☐ Check if interested in making money as an International representative with protected territory.

LAW

STUDY AT HOME

Become a lawyer. Legally trained men win high positions and big success in business and public life. Be independent. Greater opportunities now than ever before. Big corporations are headed by men with legal training. Earn

$5,000 to $10,000 Annually

We guide you step by step. You can train at home during spare time. Degree of LL.B. conferred. LaSalle students found among practicing attorneys of every state. We furnish all text material, including fourteen-volume Law Library. Low cost, easy terms. Get our valuable 64-page "Law Guide" and "Evidence" books FREE. Send for them NOW.

LaSalle Extension University, Dept. 1038-L Chicago

The World's Largest Business Training Institution

Home Wood-Turning Provides Artistic Lamps and Candlesticks

(*Continued from page* 523)

a corresponding tenon on the post and the two parts are glued together.

For the slender lamps a piece of ⅛ inch iron pipe should extend through the entire length and stick above the top about three-eighths of an inch. Both ends of this pipe are threaded and a nut is screwed on the bottom end, and countersunk in the base. A screw socket is turned on to the top end and the whole is held firmly together in this manner. With the larger lamps all that is necessary is to drive a short piece of pipe, threaded at the top, into the upper end and screw the socket to it.

The hole for the cord and pipe should be bored with a ⅜-inch bit. Pipe sizes are always given in inside diameters, and a ⅛-inch pipe has an outside diameter of ⅜ of an inch.

Several holes should be cut or bored in the bottom side of the base and melted lead should be poured into these. This same thing should be done to the candle sticks and the vases also, or the articles will be top-heavy. Another method is to screw a disc of lead to the bottom of the fixture, covering this with felt. A hole should be bored from the side of the base to the center for the cord, as one of the illustrations shows.

The finish and the shade will depend upon furniture and fittings. Lacquers and enamels give a bright touch that set a small article like this off to advantage. The present very popular pleated shade looks well on this style of lamp and they can be purchased ready-made for a small amount.

The Candlesticks

LIGHTED candles in a proper setting add a touch that never fails to charm. Unlighted candles, simply as items of decoration in beautiful candlesticks, add touches of color and novelty to the home. Low candlesticks and taller ones are illustrated in the drawings. A set of either of the low designs made in walnut or mahogany will grace the dining table. One of the low ones has a handle which may be cut out of ⅜-inch wood and fastened to the body of the holder with glue and screws or it may be left off if desired. The smaller candlesticks may be made in one piece, while the taller ones should be turned in the same way that the lamp is made. One of the candlesticks has an optional square base design which may be used if wished.

The cups for the candles are bored with a ⅞-inch bit to a depth of about ¾-inch in the square block before turning is begun. The dead center is used at this end and centered at the bottom of the hole. Only in this way can a true hole be secured without danger of splitting. Brass cups to fit candlesticks can be purchased and placed in these holes. They are not necessary, however.

Turning a Vase

WHEN one thinks of a vase he ordinarily does not associate it with wood. One can, though, make a very useful small vase that will hold a single rose, or several if the size is increased slightly by using a test tube as a water container set down into the wood.

To make this vase, secure a test tube of the desired size, bore a hole in the

INDEX TO ADVERTISERS

	Page
A	
Adams, John T.	559
Airplane Spruce Co.	555
Allied Radio Corporation	576
American Sales Co.	556
American School, The	481-558
American School of Aviation	562
American School of Photography	556
American Technical Society	560-568
American Telephone & Telegraph Co.	553
Anita Institute	566
Audel & Co., Theo.	Inside Back Cover
Aviation Institute of U. S. A.	563
B	
Barawik Co., The	553
Batenburg, P. J. F.	557
Bernard & Heller	550
Blackstone, Inc., Richard	564
Bliss Electrical School	573
Bureau of Inventive Science	550
Burns School of Wrestling	556
C	
Campbell Co., Wm.	566
Chicago Salvage Stock Store	489
Coleman, Watson E.	548
Conn, Ltd., C. G.	546
Coyne Electrical School	583
Crusader Apparatus Co.	558
D	
Deagon, Inc., J. C.	558-564
Delta Specialty Co.	557
Detroit School of Lettering	555
Dobe, Fred'k	559
Douglas, Lyle	566
Dryer, Prof. J. A.	555
Dynamic Mfg. Co.	564
E	
Encyclopaedia Brittanica, Inc.	487
Evans & Co., Victor J.	551
Excello Products Corp.	573
F	
Federal Mail Order Corp.	544-558
Federal School of Illustrating	547
Ferry & Co.	542
First Hawaiian Conservatory of Music, Inc.	571
Fisher Mfg. Co., Adam	550
Franklin Institute	571
H	
Hart Tire Co.	565
High Frequency Labs.	546
High School Home Study Bureau	567
Hobart Bros. Co.	564-567
Honigman, A.	861
Hoodwin Co., Chas.	566
I	
Ideal Aeroplane & Supply Co., Inc.	568
Inkograph Co.	Back Cover
International Correspondence Schools	542-562-566
International Heating Co.	572
J	
Jiffy-Tite Mfg. Co.	564
Johnson-Smith & Co.	566
K	
Kelsey Co., The	559
L	
Lacey and Lacey	550
Lancaster & Allwine	550
Landon School, The	556
LaSalle Extension University	564-572
L	
Lederer School of Drawing	565
Leonard, A. O.	544
Liederman, Earle	569
Lincoln Airplane School	558
Lyons Mfg. Co.	544
M	
Mead Cycle Co.	562
Merriam Co., G. & C.	544
Metal Cast Prolucts Co.	565
Midland Tire & Rubber Co.	564
Miller, Carl	548
Munn & Co.	548
N	
National Automotive & Electrical School	553-558
National Industries	568
National Radio Institute	485
National School of Meat Cutting, Inc.	556
National School of Visual Education	560
New England Mills Co.	Inside Front Cover
New Method Mfg. Co., Inc.	550-561
New York Electrical School	555
New York Institute of Photography	556
O	
O'Brien, Clarence A.	549
P	
Pacific Technical University	554
Pan-American Band Instrument & Case Co.	552-568
Payne, R. S.	568
Pathfinder Co.	565
Piccadilly Hotel	544
Plapao Labs., Inc.	568
Plymouth Rock Squab Co.	559
Polachek, Z. H.	546
P	
Process Corporation, The	566
Publishers' Classified Service	561
R	
Radio Institute of America	541
Radio Training Ass'n of America	543
Randolph & Co.	548
Ray, E. H.	554
Red Bug Bay	563
Roat & Lohman	552
S	
School of Engineering of Milwaukee	561-569
Shure Bros. Company	565
Speed Cleaner Co.	563
Speedo Mfg. Co.	573
Studebaker Corporation of America, The	545
Supra Value Shirt Co.	544
T	
Tamblyn, F. W.	544
Tarbell Systems, Inc.	573
Teleplex Co.	562
Thomas, C. M.	573
Thorola Radio Products	571
Townsend Labs.	564
Tenor Banjo Studios	567
U	
United Enterprises, Inc.	555
Universal Plumbing School	567
V	
Van Nostrand Co., D.	565
Vibraphone Co., Inc.	567
W	
Western Radio Mfg. Co.	446-564
Whirlwind Mfg. Co.	571
Wollensak Optical Co.	554

While every precaution is taken to insure accuracy, we cannot guarantee against the possibility of an occasional change or omission in the preparation of this index.

EXCELLO
Radio Consoles

Model R61

A beautiful Walnut Cabinet with sliding doors of matched Butt Walnut and selected Japanese Ash sidepanel overlays. Accommodates Buckingham, Crosley, Atwater Kent, Fada, Sparton and all standard receivers. Ample space for Receiver, Speaker, etc.

Write today for Free illustrated folder of all new styles, including Phono-Radio Combination Consoles.

EXCELLO PRODUCTS CORPORATION
4832 West 16th St., Cicero, Illinois

6 Ft. LONG

FREE!

Boys! Here's the great Navy model Airship. Large 6-foot air bag with inflators, parachute with automatic release and complete instructions for flying. Will fly for miles at height of 1000 feet. Great chance to study aerial navigation. Send name and we'll send 6 of our new art pictures to dispose of on special 25c offer. Send the $1.50 you collect and as a reward for this service we will send this wonderful Airship with full instructions free.

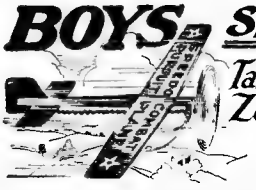
C. M. THOMAS, 337 W. Madison St., 10-K-22, Chicago

Electrical Engineering

Course for men of ambition and limited time. Over 5000 men trained. Condensed course in Theoretical and Practical Electrical Engineering including the closely related subjects of Mathematics and Mechanical Drawing. Students construct motors, install wiring, test electrical machinery. Course designed to be completed in *one college year.*

BLISS ELECTRICAL SCHOOL
Prepare for your profession in the most interesting city in the world.
Catalog on request.
150 Takoma Ave., Washington, D.C.

BOYS She Flies!

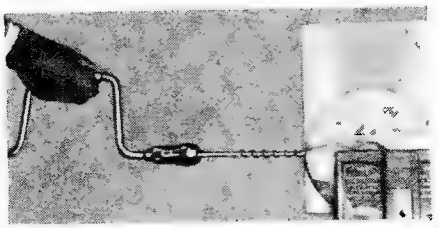


Takes Off Ground
Zooms Up High
50¢

Has wing spread 18" with main fuselage 14"; 7" carved wood propeller; 6 ply rubber motor. Soars to great heights. Completely assembled. Simply fasten wings and launch. Only 50c. Junior model—11" wing spread; 9" motor stick; 4 ply rubber motor, 25c. Both models guaranteed to fly. Special: Pure Para rubber, 1/8" flat, 1/2c foot; 3/16" flat, 1c foot. Postage all orders 5c extra. Send 2c stamp for Price List.
SPEEDO MFG. CO., Dept. E, 200 Albany Avenue, BROOKLYN, N. Y.

wood selected to the proper depth for the test tube, turn the wood either by using a cone center in the hole or by plugging it up and cutting it off to length in the lathe. By the latter method a little extra length must be added to the depth of the hole to allow for cutting off the plug end.

The ornamental vase will prove to be rather a difficult turning project because of the hollowing-out process. A block of wood large enough to make the vase is secured to a center screw face-plate, the inside is hollowed out and then the outside is turned. Of course water must not be used in it.



Bore a half hole for the cord in the base, by boring in the joint between a scrap of wood and the bottom of the base.

A Merry-Go-Round Demonstrates Einstein's Theory

(*Continued from page* 566)

R.—I beg your pardon, but I have. This scale makes no distinction, whatever between centrifugal and gravitational force. As long as I hold the scale in my hand, the gravitational force is plainly indicated by the weight of the object. When I release the rock and scale, and the pointer reads zero, I have proved that both forces have vanished. Your statement that the object, on leaving my hand, moves in a straight line, is entirely incorrect. If I could throw the rock from me with sufficient force, it would escape from the earth entirely, and revolve about the sun in an orbit of its own—an independent planet. (Fig. 6). That the index of the attached scale continues to point at zero is final evidence that no force acts on the planets.

P.—But if no force acts, why do they not move in straight lines?

R.—They do, practically.

P.—Now I know you're talking nonsense! We can plainly see that the orbits are elliptical.

R.—You are speaking about their three-dimensional special orbits. I was referring to their four dimensional space-time paths. The planets are moving in geodesics, which is the nearest thing, in four dimensional geometry, to a straight line.

L.—But why are the special orbits circles?

R.—That is due to the presence of the sun, whose mass warps the space surrounding it. If you must have a picture, try to imagine space as an extensive plain, with a tremendously high hill in the center. That hill represents the sun. If a traveller, in going through the country (Fig. 7) avoids the hill (Path ABC rather than going over it ADC) you do not ascribe his apparent deviation from a straight line to attraction or repulsion from the hill. Even in our somewhat imperfect analogy, the path ABC may be the shorter, though to an observer, who cannot see the mountain, it might not appear to be so. Although we are unable to see the hump in space around the sun, it exists nevertheless. And the Einstein theory, as I said before, is simpler than Newton's law, because no attractive force of mysterious origin is required.

if-
you pledge
yourself to secrecy we will teach you the secrets of
Real Professional
Magic

Dr. Harlan Tarbell, internationally known magician and teacher of some of the world's greatest magicians.

Learn to be a Magician

For the first time in the history of Magic the age-old, sacredly guarded secrets of the Mystic Art are being revealed. Now at last you can learn to be a Real Professional Magician. Yes, and you can learn this wonderful art *easily and quickly* AT HOME. You are taught the mysterious *Principles* by which the Professional Magician works. You are taught everything from wonderful impromptu effects to massive stage illusions. But before you can study, you must sign the Magician's Solemn Pledge of Secrecy. This means that you are getting the *guarded secrets* of the Magic Profession. Think of that!

Earn $250 to $1000 a Month
There's a big demand for Magic entertainment. Magicians get big money. Dr. Tarbell gets as high as $250 for a half hour's work. Unlimited opportunities for you!

Write for Details!

No Salesmen Will Bother You!

Mail coupon now for the free Magic literature telling all about the great Tarbell Course in Magic. Get our Low Prices and Easy Payment Plan. No salesman will ever call, bother or annoy you.

Tarbell System, Inc., Studio 14-27
1926 Sunnyside Ave., Chicago, Ill.

Tarbell System, Inc., Studio 14-27
1926 Sunnyside Avenue, Chicago, Ill.

Gentlemen: Without any obligation send me your free literature and information all about your wonderful "Tarbell Course in Magic." Also tell me about your Low Prices and Easy Payment Plan.

Name.....

Address.....

..... Age.....

OPPORTUNITY AD-LETS

YOU will find many remarkable opportunities and real bargains in these columns. It will pay you to read and investigate the offerings made every month by reliable firms, dealers and amateurs from all over the country. No matter what you may be seeking, whether supplies, automobile accessories, the opportunity to make money, or anything else, you will find listed here the best and most attractive specials of the month.

Advertisements in this section fifteen cents a word for each insertion. Name and address must be included at the above rate. Cash should accompany all classified advertisements unless placed by an accredited advertising agency. No advertisement for less than 10 words accepted.

Objectionable or misleading advertisements not accepted. Advertisements for the December issue must reach us not later than October 1st.

EXPERIMENTER PUBLICATIONS, INC., 381 Fourth Avenue, New York, N. Y.

Advertising

Get into Advertising. Learn quickly at home. Experience unnecessary. New, easy plan. No text-books used. Practical work. Old established school. Send name and address for interesting free booklet. Page-Davis School of Advertising, Dept. 533-A, 3601 Michigan, Chicago.

Advertising Agencies

Inch Display, 50 Monthlies, Thrice, $8.00. Meyer Agency, 4112 R, Hartford, St. Louis, Mo.

Agents Wanted

$60-$200 a week. Genuine Gold Letters for store windows. Easily applied. Free samples. Liberal offer to general agents. Metallic Letter Co., 441 B., North Clark, Chicago.

Big Money applying Gold Initials on Automobiles. Easiest thing today. No experience needed. $1.45 profit every $1.50 job. Free Samples. "Ralco," R1043 Washington, Boston, Mass.

$10 daily silvering mirrors, plating and refinishing lamps, reflectors, autos, beds, chandeliers by new method. Outfits furnished. Write Gunmetal Co., Ave. D, Decatur, Ill.

Agents—You can earn $12 daily wearing fine Felt Hats and show to friends. Smartest styles. Latest shades. $2 to $5 saving on every hat. Samples Free. Taylor Hat and Cap Mfrs., Dept. PC-390, Cincinnati, Ohio.

Succeed With Your Own Products. Make them yourself. Formulas, Processes, Trade-Secrets. All lines. Catalog. Circulars free. D. Thaxly Co., Washington, D. C.

You Are Wanted to resilver mirrors at home. Immense profits plating autoparts, tableware, etc. Write Sprinkle, Plater, 955, Marion, Indiana.

Big Ohio Corporation wants county manager. Opportunity $50 to $75 weekly. Earnings start immediately. Good for $5,000 yearly. We furnish everything, deliver and collect. Capital or experience unnecessary. Fyr-Fyter Co., 1907 Fyr-Fyter Bldg., Dayton, Ohio.

Gold Leaf Window Letters and Script Signs; no experience; 500% profit; samples free. Consolidated, 69-R, West Van Buren, Chicago.

$12.00 Daily Showing New Tablecloth. Looks like Linen. Wash like oilcloth. No laundering. Sample free. Bestever, 651 Irving Park Station, Chicago.

Make your own products. Employ agents yourself. Toilet articles, soap, extracts. We furnish everything. Valuable book Free. National Scientific Laboratories, 1975 W. Broad, Richmond, Va.

Big money and fast sales. Every owner buys gold initials for his auto. You charge $1.50; make $1.35. Ten orders daily easy. Write for particulars and free samples, American Monogram Co., Dept. 71, East Orange, N. J.

Carter Window Washer. Cleans, dries, polishes—one operation. 10 sales daily nets you $420.00 monthly. Good territories open. Write today. Carter Products Corp., 970½ Front Street, Cleveland, Ohio.

Agents making $40 week extra. Raincoats—$2.45. All Colors. Sample coat Free and bonus to Workers. Big Outfit Free. Bradley, 228 So. Wells, Dept. AD10, Chicago.

If you want to make $15 profit a day and get a new Ford Tudor Sedan free of cost, send me your name immediately. No experience necessary. Particulars Free. Albert Mills, 3970 Monmouth, Cincinnati, Ohio.

Strange new electric iron cord! Prevents scorching. Saves electricity. Cannot kink or snarl. Used on telephones also. $25 daily. Samples Free. Neverknot,, Dept. 10K, 4503, Ravenswood, Chicago.

Airplanes—Aviation

Simplex Air Model Co. Auburn, Mass. Send 5c for supply catalog.

Biggest, Best Catalog Model Airplanes, Parts, Supplies; 5c postpaid. Ideal Company, 23 West 18th Street, New York.

2c Postage Stamp brings you complete Model Airplane Supplies Price List. A. A. C. Model Aircrafters, Dept. S. 340 East 188th Street, New York.

Sport Plane—Plans and data for building a light sport plane. All for $1.00. H. J. Boyce, Drumore, Pa.

Airplanes—Aviation (Continued)

Propellers—1 ft., $8.75; 5 ft., $13.25; 6 ft., $16.50; Special Henderson propeller, $15.00; Aerodrive boat or sled blueprints, 50c each. Helmets, $3.00. Goggles, $3.00; both only $5.00. Engines. Ostergaard Aircraft, 4307 North Narragansett, Chicago.

Duraluminum Construction Set. Pursuit type, single seater. Light speedy Flyer. $1.25 Pospaid. Send five cents for Manual—teaches Building and Flying this plane. Foster's Model Airplanes, 5507 Hudson Boulevard, North Bergen, New Jersey.

Mounted Propeller, 12 inch and circulars on 3 foot model aeroplane, 10c. Aero Shop, 3050 Hurlbut Ave., Detroit, Mich.

Liberty Motor Generators, 12 Volts, new, complete, $7.50. Airplane machine gun telescope sights, 30 inches long, $4.50, brand new. Air Transport Company, Garden City, N. Y.

Books

Three Big Wild West Novels in magazine form—all for 50c—titles are "Gold," by Charles Snow; "Hell on Wheels," by John Breck, and "The Border Wolf," by Robert Ames Bennett—all illustrated—all individually bound novels. Send 50c for them to Mackinnon-Fly Publications, Inc., 381 Fourth Avenue, New York, N. Y.

Five Popular Detective Novels in magazine form—written by famous authors of mystery fiction—titles are—"Star of Death," by R. T. M. Scott; "The Secret Defenders," by Anne MacMahon; "Stealthy Terror," by John Ferguson; "The Taxi Murder," by J. L. Byrne, and "The Marsh Murder," by N. B. Mavity—all five for a single $1. Write to Mackinnon-Fly Publications, Inc., 381 Fourth Avenue, New York, N. Y.

Beauty Secrets worth hundreds of dollars—now yours for only 50c. A complete Encyclopedia of the art improves your beauty and personality by that famous Beauty Culturist, Eva Nagel Wolf. Large 9" by 12" book, with dozens of illustrations and over a hundred pages of helpful, invaluable advice. Send 50c to Experimenter Publications, Inc., New York, N. Y.

Business Opportunities

Sell By Mail!—Books, Novelties. Bargains! Large Profits! Particulars Free. E—Elfco, 525 South Dearborn, Chicago.

Free Book. Start little mail order business. Hadwil, 5A-74 Cortlandt Street, New York.

Learn Marbleizing and stone enameling concrete products. Learn mold making all kinds. Resembles polished marble. Dime brings samples and illustrated literature. Cowell Institute, Grayling, Mich.

Make Money. Mail Order business your opportunity. Capital unnecessary. Information, instructions and 22 plans only $1.00 postpaid. You need only ambition and this book to succeed. H. Smith, 5616 Delorimier, Montreal, Canada.

Artists and Art Students are printing 250 signs and pictures an hour without machinery. Sample and particulars 10c. Straco—1015 Mulberry, Springfield, Ohio.

Nickel-silver plate autoparts, silverware, jewelry, lighting fixtures, metal cost 50c will plate work worth $9.00. Free laboratory baths. Big money evenings in basement or spare room. Send stamp for samples, data. Lincoln Engineering Company, 855-A South 37th, Lincoln, Nebraska.

Cameras and Photography Supplies

Make money in Photography. Learn quickly at home. Spare or full time. New Plan. Nothing like it. Experience unnecessary. American School of Photography, Dept. 5332, 3601 Michigan Avenue, Chicago.

Chemistry

Booklet of chemical experiments. Illustrated, 15c. General Chemical Company, Box 397, Reading, Penna.

Your Chemical problems solved and working process furnished for Five Dollars. Write me. W. Stedman Richards, Consulting Chemist, Box 2402, Boston, Mass.

Correspondence Courses

Used correspondence school courses sold on repurchase basis. Also rented and exchanged. Money-back guarantee. Catalog free. (Courses bought). Lee Mountain, Pisgah, Alabama.

Detectives

Detectives. Work home or travel. Experience unnecessary. Particulars free. Write George Wagner, 2190 Broadway, N. Y.

Electricity

Electric Fun! Seventy stunts, 110 volts, $1. Kutting Bros., Campbell, Calif.

Employment

Obtain employment desired, quickly, anywhere. Learn how. Write Box 39-221, Station K, New York.

Engines, Motors, Dynamos

New 750 Watt, ball bearing generators, $28.00; 1250 watt, 32 volt lighting plants with engine, $169.75; ¼ hp., 32 volt motors, $9.75; ½ hp. General Electric, repulsion, a.c. motors, $27.00. All brand new. Write for bargain catalog. Do not buy, consult us first. General Distributing Company, Duluth, Minn.

For Inventors

For Selling Patents—Write to the Patent News, Washington, D. C.

Get Your Own Patents, Legal Forms, complete instructions $1. Cutting Bros., Campbell, Calif.

Inventors—We Build Models. Send us your rough idea. Our master mechanics will develop it for you into a practical working model. Thirty years' successful experience doing this very thing. Best shop equipment. Expert advice. Confidential service guaranteed. Bank reference furnished. Send for free booklet, "The Road to Success." Crescent Tool Co., Dept. D, Cincinnati, Ohio.

Blanking and forming dies. Light stampings. Machine work. B. L. Nortwed, Mitchell, So. Dakota.

Inventors. Use our special service for presenting your invention or patent to manufacturers. Adam Fisher Mfg. Co., 205-A Enright, St. Louis, Mo.

Formulas

Handy Formula Free. Send stamp. 10 additional formulas, 25c. Satisfaction Guaranteed. Neil Tasker, Shamokin, Pennsylvania.

Industrial Chemist furnishes formulas, processes; all lines. Moderate charges. Inquiries invited. Clore, Industrial Chemist, Box 152-H, Crawfordsville, Ind.

Help and Instruction

Be a Detective—Biggest paying work; everywhere. Write National Headquarters, 169 East 83rd, New York.

I Catch from 45 to 60 foxes in from 4 to 5 weeks' time. Can teach any reader of this magazine how to get them. Write for particulars. W. A. Hadley, Stanstead, Que.

Help Wanted—Instruction

Wanted Immediately, Men-Women, 18-55, qualify for permanent Government Positions, $105-$250 month; experience not required; Vacations with pay; common education; many needed soon. Write, Instruction Bureau, 293, St. Louis, Mo., quickly.

Playing With Death

(*Continued from page* 509)

these have been grossly exaggerated.

In one of the illustrations accompanying this article, we see a man who chooses to fight with an alligator daily for the edification of the audiences which crowd around to watch him. They in turn relish the battle; they like to see man conquer beast without the aid of science's modern weapons.

From the standpoint of showmanship, a man capable of supporting two others from a sword held on the back of his neck and across his shoulders becomes another interesting stunt. Should the sword slip in either direction, the man may be severely cut.

Speaking of swords, we can turn to another interesting bit of a thriller. This is presented in the following style. A man loads an improvised cannon with a small bit of dynamite. Naturally, when this cannon is fired, the recoil is quite great. In order to demonstrate to the audience that he has a steady head, he requests an assistant to hold the point of the sword against the back of his neck while he in turn holds the cannon in his mouth. Here again, everything must be balanced to a nicety.

Where a man loops the loop, in a special apparatus supported by a second performer, we find that not only is the exercise of daring necessary, but the effect combines a certain amount of skill. The same is true of the German woman who chooses to jump out of the third story window for either motion picture concerns, or for the benefit of the public and in this way gains her livelihood.

In the October Issue of

AMAZING STORIES

DEATH FROM THE SKIES, by A. Hyatt Verrill, is a unique story of exceeding interest. Being an ethnologist and archaeologist of high reputation, Mr. Verrill must necessarily be conversant with many other branches of science. He has proved his versatility a number of times, but he has outdone himself in working out this interplanetary theme.

THE SECRET KINGDOM, by Allen S. and Otis Adelbert Kline. (A serial in three parts). Part I. Do vanquished races really become submerged by the victorious nations or otherwise disappear? It may be a comparatively simple matter keeping tabs on exiled royalty or leaders nowadays; but what happened to the exiled rulers of the days before printing and wireless? Mr. Kline, who needs no introduction to our readers, gives some theories on the subject in convincing language and in a most plausible manner.

THE CHAMBER OF LIFE, by G. Peyton Wertenbaker. The author of "The Man from the Atom," comes back to us with an entirely new and original theme. It is a well-written story, picturing a perfectly ordered world.

THE STEAM GOD, by Walter Kateley, Geologic upheavals have created amazing changes and developed strange conditions, many of which have been studied by geologists. But there are still miles and miles of unknown lands. What peoples might be living in uncharted ice-lands or inaccessible valleys? Mr. Kateley has built up a story of logical sequence containing much of scientific value.

ONE LEG TOO MANY, by W. Alexander. This is still another in the series of short stories of unique development and original interest which have appeared in various issues of AMAZING STORIES. In it the author develops an ingenious idea, which is not nearly as impossible of realization as may seem on first thought.

Instruction

Want a Government Job? $1260-$3400 year. Men—Women, 18-50. Steady. No "layoffs." Pleasant work. Paid vacation. Short hours. Experience usually unnecessary. Thousands 1929 appointments. 25 coached free. Full particulars Free. Write today sure. Franklin Institute, Dept. B-4, Rochester, N. Y.

Men, women, everywhere. Manage your own business. Learn local advertising (distributing and supervising the distributing of free samples, folders, circulars, etc., and tacking-up signs). Unlimited opportunities. No selling. Complete instruction one dollar. John Wagner, Box 457, Palo Alto, Cal.

Railway Postal Clerks, $158.00-$225.00 month. Steady. Examinations coming. Common education sufficient. Men 18-35. 25 coached free. Write immediately. Franklin Institute, Dept. B-15, Rochester, N. Y.

Inventions Wanted

Inventions Wanted—patented, unpatented. If you have an idea for sale, write Hartley, Box 928, Bangor, Me.

Inventions Commercialized. Patented or unpatented. Write, Adam Fisher Mfg. Co., 205 Enright, St. Louis, Mo.

Magic and Games

Vanishing Coin Trick—Mysterious, bewildering. Amaze your friends. 20c silver. Dana, 413-S Rose Place, Long Beach, California.

100 Card Tricks for 25c. Complete descriptions for performing with dozens of illustrations—all in one big easy-to-read book. Amaze your friends with these feats of magic. Send 25c today to Experimenter Publications, Inc., 381 Fourth Avenue, New York, N. Y.

Cookoo Nuts. The fascinating new game that makes a party twice as much fun—only 25c complete. Write Experimenter Publications, Inc., 381 Fourth Avenue, New York, N. Y.

Male Help Wanted

Steamship Positions—Men—Women. Good Pay. Experience unnecessary. List of positions Free. W. E. Arculus, Mount Vernon, N. Y.

Miscellaneous

Any possible help for all Sciences. References, etc. Obvious Service, Unusual. F. L. Jones, 426, G. P. O., New York.

Brass Gears and Model Supplies—Send for Catalogue. The Pierce Model Works, Tinley Park, Ill.

Five Big Movie Novels all for $1. All individual novels, fully illustrated, in magazine form—same stories often cost you $2 each in the stores, titles are—"The Singing Fool," "The Awakening," "Noah's Ark," "Lilac Time" and "The Red Dance." Send only $1 to Mackinnon-Fly Publications, Inc., 381 Fourth Avenue, New York, N. Y.

Houdini Debunks Spiritualism. The master magician now describes how the spiritualist fools the public—all in this big, well illustrated book. Size 9" by 12"—112 pages. Book complete, only 50c. Send for it today to Experimenter Publications, Inc., 381 Fourth Avenue, New York, N. Y.

S'matter Pop—the famous comic strip artist now brings you 50 comic strips all nicely bound in a colorful book. Price only 25c. Write Experimenter Publications, Inc., 381 Fourth Avenue, New York, N. Y.

Oi! Oi! I'm Leffing. The Jewish Joke Book that keeps them laughing. Plenty of wise-cracks and plenty of fun—only 25c complete. Write Experimenter Publications, Inc., 381 Fourth Avenue, New York, N. Y.

Musical

Play Piano by Ear. A Sound System. Booklet free. Boucher's Harmony Studio, Box 12, Ottawa, Canada.

Patents

Inventions Commercialized. Patented or unpatented. Write, Adam Fisher Mfg. Co., 205 Enright, St. Louis, Mo.

Patent Attorneys

Patents Procured; Trade-Marks Registered—Preliminary advice furnished without charge. Booklet and form for disclosing idea free. Irving L. McCathran, 703 International Building, Washington, D. C.

Monroe E. Miller, Ouray Bldg., Washington, D. C. Patent Lawyer, Mechanical, Electrical Expert. Booklet and Priority Record blank gratis.

Patents—Write for Free Instructions. Send drawing or Models for Examination. Carl Miller, Registered Patent Attorney (former Patent office examiner). 258 McGill Building, Washington, D. C.

"Inventors' Guide" free on request; gives valuable information and advice for all who have original ideas or improvements. Frank Lederman, Registered Attorney and Engineer, 233 Broadway, New York City.

"Inventor's Adviser," Valuable Patentbook sent free. Lahiner, 3 Park Row, New York.

Patents—Send for form "Evidence of Conception" to be signed and witnessed. Form, fee schedule information free. Lancaster and Allwine. Registered Patent Attorneys in United States and Canada, 242 Ouray Bldg., Washington, D. C.

Inventions patented; inventions developed, correspondence invited; confidential advice; trade-marks registered; copyrights. Edward Gottlieb, Patent Attorney-Engineer, 5 Beekman Street, New York.

Patent Attorneys (Continued)

Patents. Booklet free. Highest references. Best results. Promptness assured. Watson E. Coleman, Patent Attorney, Washington, D. C.

Patents. Time counts in applying for patents. Don't risk delay in protecting your ideas. Send sketch or model for instructions or write for Free book, "How to Obtain a Patent" and "Record of Invention" form. No charge for information on how to proceed. Communications strictly confidential. Prompt, careful, efficient service. Clarence A. O'Brien, Registered Patent Attorney, Security Bank Building (directly across street from patent office), Washington, D. C. See page 549.

Inventors who derive largest profits know and heed certain simple but vital facts before applying for patents. Our book Patent-Sense gives those facts; free. Lacey & Lacey, 644 F St., Washington, D. C. Established 1869.

Patents Wanted

Inventions Commercialized. Patented or unpatented. Write, Adam Fisher Mfg. Co., 205 Enright, St. Louis, Mo.

Personal

Let me read your character from your hand-writing. Sample reading, 12c. Graphologist, 2309-BP, Lawrence, Toledo, O.

Photoplays Wanted

$ $ $ For Photoplay Plots, Stories accepted any form, revised, criticised, copyrighted, marketed. Estab. 1917. Booklet free. Universal Scenario Co., 223 Western & Santa Monica Bldg., Hollywood, Calif.

Photos, Pictures, and Postcards

Men—Samples, 20, $1.00 Sideline. Photo-G. P. O., Box 471, New York.

Free Book—"What men know about women." Humorous and interesting. Kind men like. 10 snappy cards. Red hot pocket novelty. Copy America's greatest illustrated cartoon book. All for 25c. White Mule, Beaver Dam, Wis.

Printing Outfits and Supplies

Print Your Own cards, stationery, circulars, advertising, etc. Junior press, $5.90; job presses, $11; rotary, $149. Print for others; big profit. Easy rules furnished. Write for catalog presses, type, paper, etc. Kelsey Company, Q-6, Meriden, Conn.

Radio

Licensed Radio Doctors earn $75-$100 per week. Big demand; investigate at once. Free Booklet. Radio Doctors, Inc., Dept. E, Essex St., Salem, Mass.

Get Commander Byrd's messages from the Antarctic—with a Short Wave Radio Set. Complete Short Wave Manual with instructions for building and full size blue prints—all for 50c. Write today to Experimenter Publications, Inc., 381 Fourth Avenue, New York, N. Y.

Salesmen Wanted

Punchboard Salesmen. $10,000 Yearly. New Line. All fast sellers. Lowest prices. Full commission on repeat business. Catalog Free. Hurry! Puritan Novelty Co. 1409 Jackson, Chicago, Ill.

Amazing screw-holding screw driver! Factories, garages, workers buy on sight! Profit 75c each. Exclusive territory. Free trial offer. Jiffy, 1177 Winthrop Bldg., Boston.

Sales Promotion

Anything can be sold by mail. Banning, Times Bldg., ing, Watertown, N. Y.

Song Poems

Song Poem Writers: "Real" Proposition. Hibbeler, D191, 2104 N. Keystone, Chicago.

Songwriters

Free! Song Writers' Guide. Beaver, D-24-1257 Elm, Green Bay, Wis.

Songwriters: Submit your song-poem or complete song. Will return it immediately if not accepted. Chester Escher, Music Publisher, 125 W. 45th St., New York City.

Songwriters: Substantial Advance Royalties are paid on publishers' acceptance. Write for free booklet on developing ideas for song, words or music required by Talking Pictures. Newcomer Associates, 1674 Broadway, New York.

Telegraphy

Learn Morse and wireless telegraphy. Big salaries. Tremendous demand. Expenses low, can earn part. Catalog free. Dodge's Institute, Stone Street, Valparaiso, Indiana.

Wanted to Buy

Mail us your discarded jewelry, gold, crowns and bridges, watches, diamonds, silver, platinum. Money promptly mailed. Goods returned if offer refused. United States Smelting Works (The Old Reliable), 39 So. State St., Dept. 3, Chicago.

196 Page FREE CATALOG

The new SCREEN GRID A-C RECEIVERS

RADIO
the new SCREEN GRID models

WHOLESALE PRICES!

THIS NEW big catalog—just off the press—heralds values never before approached in radio merchandising. Prices have never been lower—or quality so high. Send for your copy today. See for yourself the astounding values we offer—the actual wholesale prices at which you can now buy. Our recent purchases totaling over one million dollars ($1,000,000) in standard radio receiving sets coupled with our tremendous stock of standard accessories, parts and kits has enabled us to make startling price reductions. Write today for the complete story as given in this large 196 page catalog of radio bargains.

EVERYTHING IN RADIO AT UNHEARD OF PRICES

New Screen Grid A. C. Humless All-Electric sets—standard A-C sets as well as battery operated receivers in an attractive array of consoles ranging from small table model types to gorgeous pieces of radio furniture. They represent the finest offerings of the season. The price range is especially attractive presenting unusual values as low as $15.95.

Get this Allied catalog. Buy low so you can make more profit. Deal with an organization of experts who are trained to render real service in radio.

$15.95

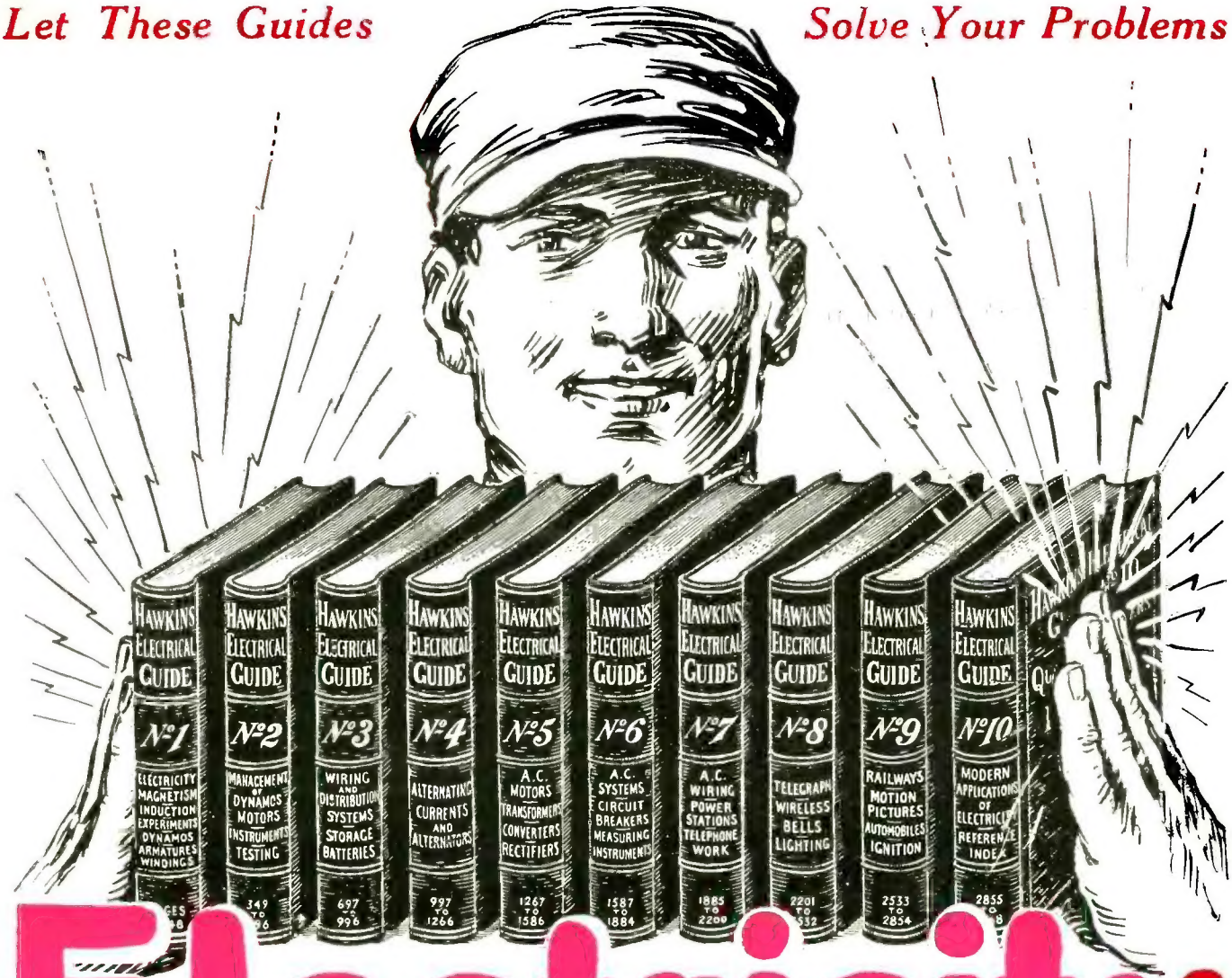
A Reliable, High-grade Radio House

ALLIED RADIO CORPORATION

711 W. Lake Street • Dept. D-1 Chicago

Backed by Resources totaling over $3,000,000

Let These Guides *Solve Your Problems*



Electricity at your finger ends

HAWKINS ELECTRICAL GUIDES IN TEN VOLUMES

3500 PAGES
4700 PICTURES

$1 A VOLUME
$1 A MONTH

Know the facts in Electricity. They mean more money and better position for you. Hawkins Guides tell you all you need to know about Electricity. Every important electrical subject covered so you can understand it. Easy to study and apply. A complete, practical working course, in 10 volumes. Books are pocket size; flexible covers. Order a set today to look over.

LEARN ALL ABOUT

Magnetism—Induction — Experiments — Dynamos — Electric Machinery—Motors—Armatures—Armature Windings—Installing of Dynamos—Electrical Instrument Testing—Practical Management of Dynamos and Motors—Distribution Systems—Wiring—Wiring Diagrams — Sign Flashers — Storage Batteries — Principles of Alternating Currents and Alternators — Alternating Current Motors — Transformers — Converters—Rectifiers—Alternating Current Systems—Circuit Breakers—Measuring Instruments—Switchboards—Wiring—Power Stations—Installing —Telephone—Telegraph—Wireless—Bells—Lighting—Railways. Also many Modern Practical Applications of Electricity and Ready Reference Index of the ten numbers.

SHIPPED FREE

Not a cent to pay until you see the books. No obligation to buy unless you are satisfied. Send Coupon now—today—and get this great help library and see if it is not worth $100 to you—you pay $1.00 a month for ten months or return it.

SEND NO MONEY—SEND ONLY THIS COUPON

THEO. AUDEL & CO.
65 West 23rd Street, New York City

Please submit me for free examination, HAWKINS ELECTRICAL GUIDE (Price $1 a number). Ship at once prepaid, the 10 numbers. If satisfactory, I agree to send you $1 within seven days and to further mail you $1 each month until paid.

Name.....

Occupation.....

Employed by.....

Home Address.....

Reference.....

S. I. OCT.

It's all they say it is - and more!

FRANKLIN SURETY Co.
Assets over
$1,000,000
Guarantees Fulfillment of All Promises in this Ad.

ONLY $1.50

$1,000 REWARD
to anybody who can prove that these testimonials were solicited by us.

Inkograph has proven so satisfactory and has elicited considerable favorable comment am enclosing money order, please send me three more. T. J. Prow, Traveling Claim Agent, Joplin, Mo.

The Inkograph fully justifies all claims you make. I own a Waterman but Inkograph is far preferable. Frank R. Sargent, Oakland, Calif.

You have one of the best writing instruments I ever used regardless of price. I use the lowest grade stationery and there is never a blotch or scratch because of it's round smooth point. It is a wonderful invention. H. L. Coley, Albano, Va.

Oh, boy. I am tickled skinny to have the Inkograph. It's a darling. I can now make carbon copies in taking orders and send originals in ink to factory instead of a penciled sheet. It surely flows over the paper as if it was grease instead of ink. No trouble at all and a thing I could not do before to trace straight lines very fine and clean. No smear, no mess of any kind. It's just great. E. A. Simms, Jersey City, N. J.

My Inkograph is the smoothest writing instrument with which I have ever written. That is saying a lot. I am a teacher by profession. I have a $7.00 pen and another that cost more than the Inkograph, but Inkograph is better than either. It is the greatest improvement in writing instruments since the Babylonians recorded their thoughts on clay tablets with a triangular pointed reed. John R. Atwell, Chadwick, N. C.

My Inkograph is the first and only writing utensil I ever owned that I can use with pleasure. To be without it for any time would upset my business day. It has always worked perfectly. I have never had any difficulty with it. Arthur L. Fox, Centerville, Mich.

I am a bank teller, have used all kinds of fountain pens, but can honestly say for my work I never found a pen so easy and tireless to write. You can pick it up any time in any position and write immediately and all numbers and words will be the same. Try and do it with any other pen. My buddies all agree that it is best for our work. C. R. Morley, Allentown, Pa.

Delighted. It writes bully—you have invented a pen that is perfection. It is so much more rapid than my $9.00 fountain pen. I wish you abundant success. S. L. Carlton, Aurora, Ill.

I am very well pleased with my Inkograph. It is just what I have been looking for. I have had several ink pencils but nothing like the Inkograph; it writes like the point was greased and it makes no difference what kind of paper. It is fine for shipping clerks. S. I. Jarrett, Harrisville, W. Va.

The Inkograph, I am thoroughly convinced, is the best writing instrument I have ever used. It is sure, sane and clean and always ready to use. I am very well pleased with it. J. E. Rumpton, Pensacola, Fla.

Your Inkograph is everything you state. It is just wonderful. So send me two more. Arthur Olicott, Tucker, La.

AGENTS A big value which sells on sight. Writes smoothly and is handier than any fountain pen. Big profits, quick sales, no investment, no competition, quick commissions. Send for Inkograph and with it receive order book, so you can take orders at once, or write for FREE sales plan booklet.

THE WRITING HEMISPHERE

That hard smooth ball-like 14 kt. gold point which makes possible writing in ink, over the coarsest paper, as rapidly as with softest lead pencil.

Prices Outside U. S. A., $1.50 styles $2.50; $3.00 styles $4.00. Remittance must accompany order

ANSWERS the purpose of pen and pencil combined! Actually improves your handwriting!
Writes freely and easily without a miss, skip or blur!
Never blots, balks, dries up, scratches, leaks or soils hands!
Writes equally well on rough or smooth paper!
Wonderful for making carbon copies with original in ink!
Draws lines to a ruler without smear or smudge!
That's what thousands of satisfied Inkograph users say. Many tell us it is the best writing instrument they have ever used regardless of price. Unlike a fountain pen, anyone can use your Inkograph without fear of spreading or injuring its 14-kt. solid gold point.

Take advantage of our free 10 day trial offer and test the most satisfactory writing instrument you have ever used.

FREE 10 DAYS TRIAL

THE NEW IMPROVED

INKOGRAPH

"PENCIL POINTED PEN"

The Perfect Writing Instrument

PATENTED 1, 27, 1925

TRADEMARK Reg. U. S. Pat. Off.

Combines the Best Features
of both pen and pencil, minus the weak points of both, plus improvements not found in either.

A Pen of Refinement
Made of finest quality, highly polished, black fountain pen material, with 14-Kt. solid gold point and feed, safety screw cap, self-filling lever and clip. In workmanship, quality and appearance it is the equal of pens selling for a great deal more.

Cannot Leak
Not the tiniest drop of ink will spill, although one filling is sufficient to write thousands of words.

Patent Automatic Feed
prevents clogging. No complicated mechanism to clean or get out of order.

Makes 3 to 4 Carbon Copies
at one time with original in ink. Bear down as hard as you like, without fear of bending, spreading, injuring or distorting its 14-Kt. solid gold point.
Ideal for Salesmen's Orders, Private Correspondence, Office, Sales and Billing Records or any work requiring exceptionally clear carbon copies.

If Dissatisfied With Your Fountain Pen
—try the Inkograph, it's all we ask. If it does not prove entirely satisfactory, is not handier and superior, and does not write smoother than any fountain pen you ever used, whether it cost $5, $6, $7, or $8, return it to us and we'll refund your money.

INKOGRAPH CO., Inc., 159-199 Centre St., New York, N. Y.

DEALERS Stationery Stores, Drug Stores, Department Stores, etc., send for our catalog and trade prices.

Also Made In very attractive $3.00 styles, red, black or mottled hard rubber with 14-kt. gold filled band and clip on cap, gold self-filling lever, same size as $7 and $8.75 fountain pens. Same colors and trimmings in smaller sizes. All $1.50 styles are black only with nickel clip and self-filling lever.

Only when ordering $3.00 style mark X after color desired.

Black ☐
Red ☐
Mottled ☐

Send No Money Your name and address are sufficient.

INKOGRAPH CO., Inc., 159-199 Centre St., New York

You may send me Inkograph. I will pay postman $.... plus postage on delivery.

Note When remittance accompanies order, Inkograph will be sent postpaid.

If you prefer small size with ring on cap for ladies' sautoir or men's watch chain.

Mark x here ☐

Name .....

Address .....

City ..... State .....